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FOREST PRESERVATION

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THIRD ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF

MINNESOTA

UNDER THE ACT OF THE LEGISLATURE ENTITLED
"AN ACT TO PROVIDE FOR THE PRESERVATION OF FORESTS OF THIS STATE
AND FOR THE PREVENTION AND SUPPRESSION OF FOREST AND
PRAIRIE FIRES," APPROVED APRIL 18, 1895.

FOR THE YEAR 1897.

ST. PAUL, MINN.:
PRINTED BY THE PIONEER PRESS COMPANY.
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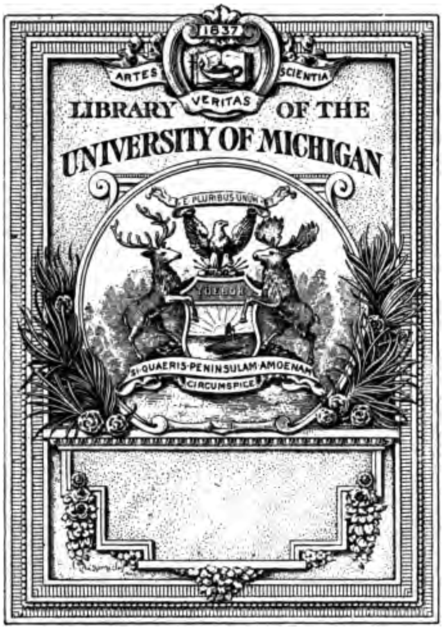
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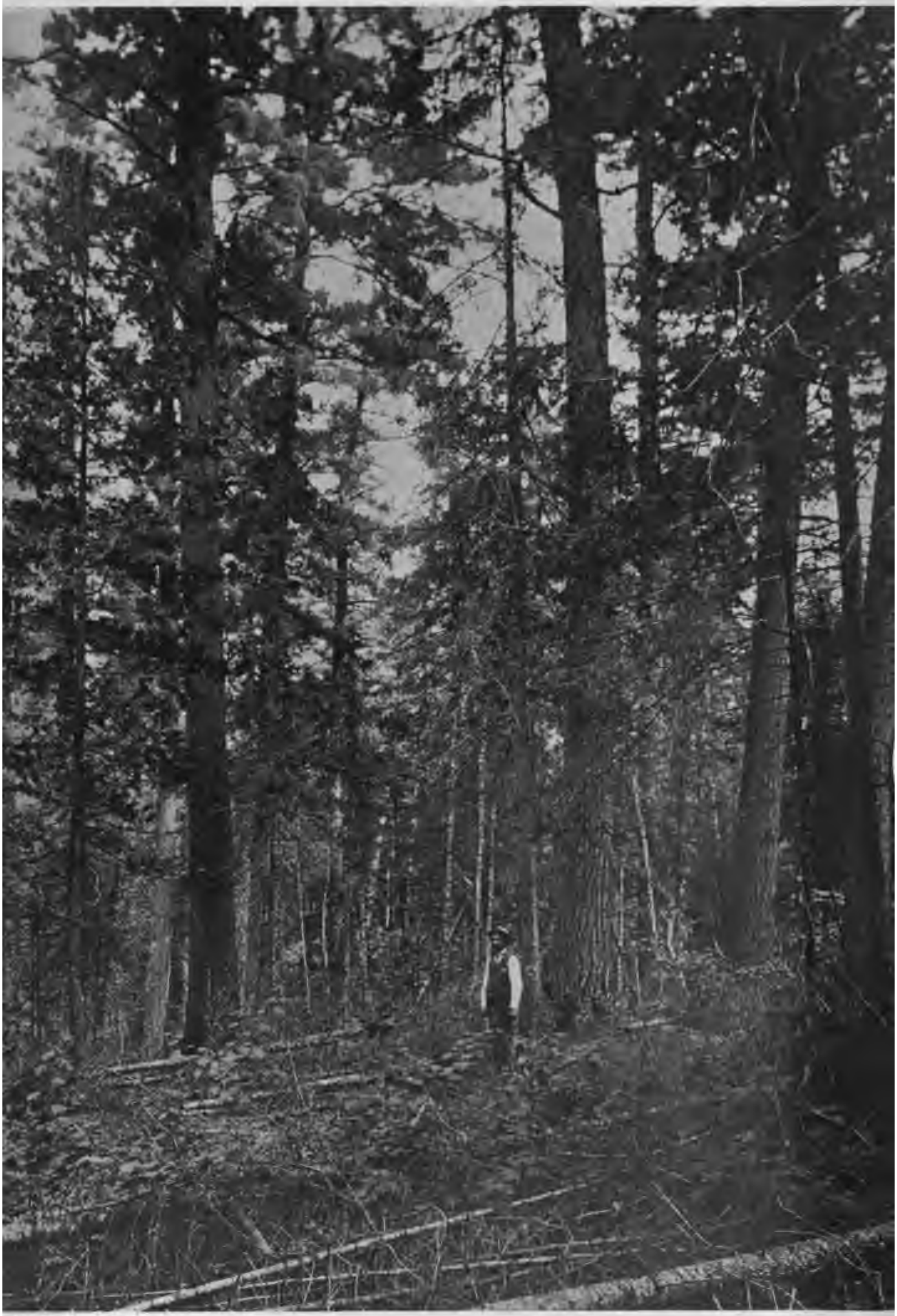

by F. L. Hoxsie.

*MO*DERATELY CLOSE STAND OF WHITE PINE, ITASCA COUNTY (1897).

FOREST PRESERVATION

THIRD ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF

MINNESOTA

UNDER THE ACT OF THE LEGISLATURE ENTITLED
"AN ACT TO PROVIDE FOR THE PRESERVATION OF FORESTS OF THIS STATE
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FOR THE YEAR 1897.

ST. PAUL, MINN.:
PRINTED BY THE PIONEER PRESS COMPANY
1898.

STATE OF MINNESOTA,
OFFICE OF CHIEF FIRE WARDEN,
ST. PAUL, March 31, 1898.

Hon. R. C. Dunn, State Auditor and Forest Commissioner,

SIR: As required by section 3 of the Act for the Preservation of Forests, etc., approved April 18, 1895, I have the honor to submit, herewith, my annual report for the year 1897.

Very respectfully,
C. C. ANDREWS,
Chief Fire Warden.

THIRD ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF MINNESOTA.

About three weeks of very dry weather prevailed in the latter part of April and first part of May, 1897, in an extensive forest area, the center of which was the southern part of Beltrami county. Some damage was done to standing white pine in that county, but the loss was reduced by the pine being cut the present season. A fair proportion of the fires was extinguished or controlled by fire wardens and citizens who assisted them. It is an interesting fact that the timber on the Itasca State Park which was threatened by a dangerous fire was saved from damage, partly by the efforts of fire wardens. The total number of acres of forest land, including light brush and marsh, burned over was 66,020. The total amount of damage was $22,455. Considering that the standing timber in the state, at a low valuation, is worth $100,000,000, the amount of damage is small. Sixty-one per cent of the forest fires were extinguished or controlled by fire wardens.

Further particulars in regard to forest fires will be found in the following summary:

SUMMARY OF FOREST FIRES, 1897.

County and Towns.	Date.	Acres.	Damage.	Cause.
Becker County—				
Burlington	May 15	160	$80	Railroad locomotive.
Cormorant	Sept. 23	15	22	Threshing engine.
Erie	June 10	2	None	Burning brush.
Evergreen	May 15	*400	10	Burning meadow.
Green Valley	May 4	240	35	Unknown.
Height of Land	April 12	75	175	Unknown.
Osage	May 5	3,000	5,000	From Indian reservation
Richwood	May 2	1,500	400	Unknown.
Silver Leaf	May 9	100	300	Unknown.
Silver Leaf	May 16	200	100	Burning brush.
Walworth	April 18	640	50	Railroad section men.
Wolf Lake	March 8	200	25	Burning brush.
Township 141-36	April 17	160	25	Indian camp fire.
Township 141-36	April 19	3,000	600	From adjoining town.
Beltrami County—				
Bear Creek	May 3	1,700	800	Clearing land.
Bear Creek	May 5	1,000	200	Clearing land.
Moose Creek	May 3	6,000	1,000	From Indian reservation
Township 144-36	May 2	6,400	150	Burning meadow.
Township 147-37	May 10	*600	Slight	Camp fire.
Township 147-37	Aug. 18	100	450	Indian camp.
Township 149-30	Oct. 6-9	25	200	Camp fire.
Township 150-31	Oct. 3	25	1,000	Camp fire.
Township 150-34	Oct. 1	2,500	1,000	Camp fire.
Township 150-36	June 28	1,200	500	Camp fire.
Benton County—				
Glendorado	April 28	160	None	Unknown.
Mayhew Lake	Oct. 18	40	20	Unknown.
Carlton County—				
Knife Falls	April 26	30	200	Sparks from saw mill.
Crow Wing County—				
Crow Wing	May	*2,000	None	Unknown.
Deerwood	May 19	40	None	Burning brush.
Maple Grove	April 15	300	None	Burning R. R. rg't of way
Oak Lawn	May 7	500	200	Clearing land.
St. Mathias	May 1	2,400	100	Unknown.
Township 138-27	Sept. 2	3	None	Railroad locomotive.
Hubbard County—				
Akely	May 6	60	100	Clearing land.
Arago	May 15	600	100	Clearing land.
Henrietta	May 8	300	500	Unknown.
Lake Emma	May 1	2,000	Slight	Camp fire.
Township 139-33	Oct. 1	100	Slight	Hunters.
Township 142-32	May	....	200	Unknown.
Township 143-32	May	....	600	Unknown.
Township 144-35	May	1,000	300	Burning brush.
Township 144-34	May	2,000	500	Hunters.
Itasca County—				
Township 54-22	April 27	120	50	Burning R. R. rg't of way
Township 57-25	Oct	100	50	Unknown.
Township 151-29	Sept. 25	5	150	Clearing land.

SUMMARY OF FOREST FIRES—*Continued.*

COUNTY AND TOWNS.	Date.	Acres.	Damage.	Cause.
Kanabec County—				
Hillman	May	*6,000	$500	Burning marsh.
Kandiyohi County—				
New London	May 23	200	800	Unknown.
Morrison County—				
Clough	April 25	60	200	Clearing land.
Clough	May	160	300	Camp fire.
Cushing	April 19	100	100	Unknown.
Cushing	April 21	320	300	Clearing land.
Little Falls	May 4	1,200	500	Burning brush.
Mount Morris	Oct. 29	80	None	Burning meadow.
Pike Creek	April 25	2,500	100	Clearing land.
Scandia Valley	May 14	1,800	None	Unknown.
Otter Tail County—				
Homestead	April	300	None	Clearing land.
Pine County—				
Chengwatana	April 25	1,200	300	Unknown.
Pine City	May 30	640	None	Unknown.
Polk County—				
Rosebud	May 1	*150	30	Burning rubbish.
Todd County—				
Faun Lake	April 27	5,000	2,000	Unknown.
Germania	May 2	300	200	Clearing land.
Grey Eagle	April 25	300	50	Burning meadow.
Iona	April 27	*250	Slight	Clearing land.
Reynolds	April 27	100	....	Clearing land.
Round Prairie	May 10	80	50	Unknown.
Villard	April 27	1,800	2,000	Railroad locomotive.
Wykeham	April 15	160	600	Clearing land.
Wadena County—				
Lyons	May 7	*360	None	Clearing land.
Lyons	May 8	1,200	None	Unknown.
Thomastown	May 2	*600	35	Unknown.
Thomastown	May 8	160	None	Clearing land.

* Brush and meadow.

Total acres burned over, 66,020. Damage, $22,455.

Classification of causes:

- From clearing land, 16.
- From burning brush and meadows, 11.
- From camp fires and hunters, 11.
- From railroad locomotives, 3.
- From other causes, 8.
- Unknown, 21.

Very dry weather prevailed in the autumn over a large extent of prairie country. The principal fires occurred in Roseau county. The ground was bare of snow in much of the prairie country through November and December, and some fires occurred in both those months. The total area burned over by prairie fires was 97,146 acres, and the damage was $14,554. The reports showed that thirty-seven prairie fires were extinguished or controlled by fire wardens and their helpers.

SUMMARY OF PRAIRIE FIRES, 1897.

COUNTY AND TOWNS.	Date.	Acres.	Damage.	Cause.
Big Stone County—				
Big Stone	April 31	400	None	Burning stubble.
Big Stone	May 3	200	None	Unknown.
Moonshine	Sept. 29	480	$1,300	Threshing engine.
Chippewa County—				
Grace	Nov. 6	1,000	35	Burning grass.
Louriston	Nov. 6	300	30	From adjoining town.
Rheiderland	April 16	100	None	Unknown.
Clay County—				
Alliance	April	50	50	Burning grass.
Cromwell	May 7	150	None	Railroad locomotive.
Cromwell	Sept. 27	75	None	Camp fire.
Hagen	Nov. 25	600	50	Threshing engine.
Morken	Nov. 5	15	25	Threshing engine.
Kittson County—				
Deerwood	May 1	400	None	Unknown.
Lac qui Parle Co.—				
Garfield	Nov. 16	500	90	Unknown.
Manfred	April	1,400	....	Burning grass.
Mehurin	Sept. 24	40	60	Burning straw.
Mehurin	Nov. 16	2,000	150	Unknown.
Perry	Sept. 29	40	Slight	Railroad locomotive.
Walter	Sept. 20	10	Slight	Railroad locomotive.
Walter	Sept. 23	60	225	Railroad locomotive.
Walter	Sept. 27	80	Slight	Railroad locomotive.
Walter	Sept. 28	30	38	Railroad locomotive.
Walter	Sept. 29	40	Slight	Railroad locomotive.
Walter	Oct. 2	30	Slight	Railroad locomotive.
Lincoln County—				
Lake Stay	Oct. 27	640	50	Boys with matches.
Limestone	Nov. 17	1,900	25	Unknown.
Verdi	April 27	1,100	120	Burning straw.
Marshall County—				
Alma	May 10	600	60	Unknown.
Comstock	April 30	50	75	Burning grass.
Grand Plain	Nov. 12	200	None	Unknown.
New Folden	Dec. 1	160	20	Unknown.

SUMMARY OF PRAIRIE FIRES.—*Continued.*

County and Towns.	Date.	Acres.	Damage.	Cause.
Murray County—				
Ellsborough	May 12	200	200	Burning stubble.
Norman County—				
Good Hope	Nov. 17	5,000	None	Unknown.
Pipestone County—				
Ætna	Oct. 28	2,000	400	Railroad locomotive.
Altoona	Nov. 3	160	20	Burning straw.
Osborn	October	300	....	Unknown.
Polk County—				
Badger	May 5	840	40	Unknown.
Belgium	Oct. 23	200	None	Clearing land.
Belgium	Nov. 20	2,000	None	From adjoining town.
Hammond	Nov. 9	500	None	Unknown.
Hammond	Nov. 12	600	50	Unknown.
Hertsville	Nov. 20	200	None	Unknown.
Onstad	Oct. 8	5	None	Locomotive engine.
Russia	Nov. 26	800	None	Unknown.
Pope County—				
Hoff	May 3	200	150	Unknown.
Red Lake County—				
Bray	Nov. 5	200	None	Unknown.
Bray	Nov. 20	2,000	None	Unknown.
Lake Pleasant	Oct. 14	10	$50	Burning straw.
Polk Centre	May 2	1,000	100	Burning grass.
Rocksbury	Dec. 4	1,900	150	Unknown.
Saunders	May 12	500	11	Unknown.
Saunders	Nov. 19	250	20	Unknown.
Redwood County—				
Gales.	May 2	400	500	Unknown.
Waterbury.	Nov. 27	5,000	125	Unknown.
Roseau County—				
Barto	Oct. 2	15,000	1,500	Burning fire break.
Deiter	Aug. 20	8,000	2,000	Burning fire break.
Pohlitz	Oct. 1	300	1,600	From adjoining town.
Skagen	Oct. 7	2,000	165	Unknown.
Soler	Oct. 3	15,000	1,100	Burning fire break.
Spruce	Nov. 11	200	30	Burning fire break.
Stearns County—				
Crow River	Sept. 8	2	25	Lightning.
Stevens County—				
Eldorado	Oct. 10	18	None	Burning fire break.
Everglade	Nov. 1	4,000	125	Burning straw.
Swift County—				
Cashel	Nov. 16	200	40	Unknown.
Clontarf	Nov. 20	4,000	None	Unknown.
Tara	Nov. 15	1,600	None	Unknown.
Traverse County—				
Dumont, village of	Dec. 30	10	None	Accident.
Dollymount	Sept. 30	40	800	Steam thresher.
Taylor	Oct. 3	*1	65	Steam thresher.

SUMMARY OF PRAIRIE FIRES.—*Continued.*

County and Towns.	Damage.	Acres.	Damage.	Cause.
Wilkin County—				
Akron	Oct. 2	1,500	400	Burning straw.
Champion	Oct. 1	70	450	Railroad locomotive.
Champion	Oct. 4	15	30	Threshing engine.
Manston	Oct. 2	2,000	800	Unknown.
Meadows	Sept. 23	3,000	400	Unknown.
Mitchell	April	1,800	50	Burning straw.
Mitchell	Nov. 18	1,200	None	From adjoining town.
Nordick	Oct. 2	600	300	From adjoining town.
Nordick	Oct. 20	20	....	Threshing engine.
Roberts	Oct. 15	5	40	Unknown.
Yellow Med. Co.—				
Burton	April 23	2,000	None	Unknown.
Burton	Oct. 27	800	100	Burning fire break.
Burton	Nov. 13	1,500	85	Unknown.
Florida	May 7	640	200	From Dakota.
Minnesota Falls	October	10	Slight	Railroad locomotive.

* Field.

Total acres burned over, 97,146. Damage, $14,554.

Classification of causes:

Railroad locomotives, 11.
Threshing engines, 8.
Burning straw or stubble, 8.
Burning fire breaks, 8.
Other causes, 16.
Unknown, 33.

FIRE WARDENS' REPORTS OF FIRES.

Section 7 of the Fire Warden Law provides that, "the chairman of boards of township supervisors, presidents of villages and fire wardens appointed by the Chief Fire Warden shall inquire into the cause of each forest or prairie fire within their districts and shall report the same to the Chief Fire Warden and the methods used to control or extinguish such fires, and the amount of property destroyed and the number of lives lost, if any, and report such other facts in regard to said fires as said Chief Fire Warden may require. During the more dangerous season of the year the Chief Fire Warden may require frequent reports from

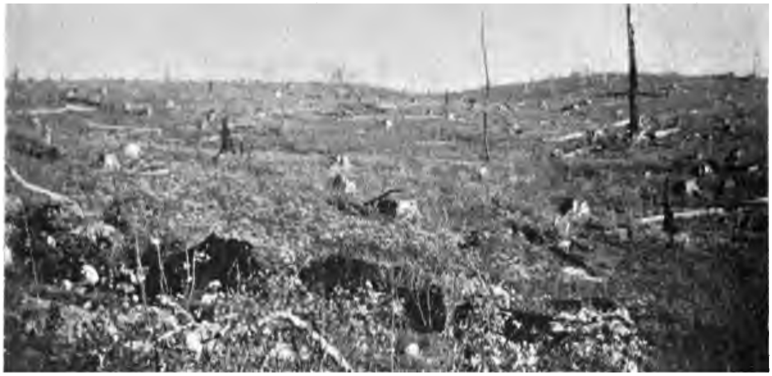


Photo by F. L. Hoxsie.

CUT AND BURNED OVER PINE LAND IN HUBBARD COUNTY.

the chairman of township boards, or in unorganized towns, from fire wardens appointed by the said Chief Fire Warden, as to condition of forest and prairie fires, and as to what is being done to control the same."

It is thus seen that in organized towns it is the duty of the chairman of the town board to report in regard to fires. When shall he make his report? The law means, of course, that he shall make and send his report in reasonable time. And what is reasonable time? If a man were to contract to put in a crop of wheat, the law would hold that he should do it in reasonable time; and two weeks after a suitable time would not be reasonable time. So in reporting fires, the meaning of the law is that they should be reported promptly, or as soon as a thorough and business-like inquiry into the cause of the fire can be made. It is only by thoroughly investigating, fixing responsibility and prompt reporting fires, that the habit of carelessness in causing them can be checked.

Copies of a blank, of which the following is a condensed form, on half letter sheet with return stamped envelopes, were duly furnished to chairmen in organized towns and to appointed fire wardens in unorganized towns; and the reports of fires that were made are preserved in the office of the Chief Fire Warden.

STATE OF MINNESOTA.

FIRE WARDEN'S REPORT OF FIRE.

To the Chief Fire Warden, St. Paul, Minn.:

A [state whether forest, prairie or field fire]......................fire occurred in the [state what part of town]......................part of the Town of..................... being Township No...............Range...............in the County of..................... on the...............day of......................[state about what time of day].............. It burnt over...............acres of [state kind of land, whether field, prairie, brush, meadow, heavy or light timber]......................destroyed...................... and did damage to the amount of...................... Said fire originated on Section No................being land occupied by......................[if vacant so state]

..and was caused by [explain how it originated]
..
..
..
The fire was extinguished in.......................hours after it started. There were ....persons called to help extinguish it. [If none were called, so state.] The number of persons assisting in extinguishing the fire was......... The fire was extinguished in the following manner....................................
..
..
..
The weather was...
[Add any other facts bearing upon the matter. Also, give the name of any one who rendered particularly praiseworthy service and what service; and the name of any Fire Warden who was present and assisted in controlling or extinguishing the fire.]

P. O.. Signature..
Date.. Name of Organized Township.................

PRECAUTIONS AGAINST FIRES.

Under date of May 26, 1897, three copies of the following circular of instructions were mailed to the chairman of each town board of supervisors in each organized town in forest and prairie regions, so that a copy could be furnished to each supervisor:

C. C. ANDREWS,
Chief Fire Warden.

R. C. DUNN (State Auditor),
Forest Commissioner.

STATE OF MINNESOTA,
OFFICE OF CHIEF FIRE WARDEN,
St. Paul, Minn., May 26, 1897.

To Fire Wardens:

I. A package containing ten warning placards has just been mailed from this office to each chairman of town board and to each fire warden in unorganized territory, and they should be carefully posted, as provided by Section 4 of the Forest Preservation Act of April 18, 1895. If any should be received by chairmen in towns so much settled as not to require precautions against forest or prairie fires the town board can exercise its discretion in regard to their being posted.

II. Chairmen are requested to promptly fill and return the blank entitled "Fire Wardens for 1897;" also, hand to their colleagues a copy of within circulars, which should be carefully studied.

III. Section 6 of said law requires you to "TAKE PRECAUTIONS TO PREVENT the setting of forest or prairie fires." It may be about impossible to extinguish a forest fire in dry and very windy weather, but if fire wardens do their duty thoroughly they can almost entirely prevent the occurrence of dangerous fires. It is a violation of Section 9 of the Act for anyone to set a fire in dry weather. Fire wardens must make this known and they must firmly enforce the law by exemplary prosecutions. This is the third year the law has been in operation and it should now be strictly enforced. Fire wardens will themselves be liable to prosecution if they fail to have it so enforced. They should take a pride in being able to report at the end of the season that no fires have occurred in their town.

IV. The annual reports of fire wardens for 1896 show there were in that year fifteen less forest and prairie fires caused by railroad locomotives than in 1895. There is, however, much room for further improvement. An engineer whose locomotive sets fire a second time should be prosecuted. It would not be advisable, however, on making arrest to take him from his train, but he should have a week or ten days' notice in which to appear and answer before the court. Such offenses are likewise indictable by the grand jury. Fire wardens owe it to themselves to see that there is in their districts a marked decrease of fires caused by railroad locomotives.

V. Complaint has been publicly made within the last few months that fires have been set by people to obtain pay for putting them out. Such criminal and disgraceful proceedings may have occurred in a few instances, but they certainly cannot be common. Fire wardens who have reason to suspect any offense of this sort should, for the honor of their community, have it stopped, and it is hoped they will use a wise course and accomplish such object.

VI. Several complaints have been received from fire wardens that the county commissioners have refused to audit their accounts. Under Section 8 of the Forest Preservation Act of April 18, 1895, county commissioners have authority, and it is their duty, to reject any item or account if they are not satisfied of its justice. They cannot, however, arbitrarily refuse to audit (examine and settle) an account. If they were to so do, or unjustly disallow accounts, they would practically nullify the law. It is their duty to "audit" the accounts of fire wardens and their helpers and allow what, as fair-minded men, they are satisfied is just. Section 8 of Chapter 91 of the General Laws of Minnesota 1878 applies to all public officers.

VII. The diffusion of knowledge in respect to forestry will promote observance of the Forest Preservation Act. When people understand how much the wealth of our state could be increased by a proper management of its forest resources they will be much more careful about causing forest fires. Forestry means the raising of timber on land not suitable for agriculture. In Saxony and Wurtemberg (among other countries) which have long had superior forestry management, a continuous annual net profit of from $3 to $4 per acre is derived from the forests. If Minnesota will lay the foundations of a good forestry system (and the prevention of forest fires is the first important step in such a system) it will build up a continuous, increasing and grand labor-furnishing resource, and those who are doing ever so humble a part in the feeble beginning of this work may feel that they are rendering honorable service to their community and state.

Thousands of new settlers and farmers in the older states made the great mistake of clearing up land that was only suitable for forest. From such tracts they obtained a very few crops and then the land rapidly degenerated till now it is, in many places, but little else than naked sand. Whereas, if they had left such tracts in forest it would have been a source of continuous profit to them. Many settlers in northern Minnesota are repeating the same mistake. It would be more profitable for them if they would look further into the future and retain in forest every acre that is really unsuitable for agriculture.

The more you can interest people in the important subject of forestry the lighter will be your work of enforcing the law.

Very respectfully,
C. C. ANDREWS,
Chief Fire Warden.

FIRES SET BY RAILROAD LOCOMOTIVES.

The Fire Warden Law imposes many precautions upon railroad companies for the prevention of forest and prairie fires. They are to use efficient spark arresters on all their engines and keep their rights of way clear of all combustible materials; in dry seasons they are to give "particular instructions" to their employes for the prevention and prompt extinguishment of fires. The number of forest fires reported as having been caused by railroad locomotives in 1897 was three, and the number of prairie fires reported as so caused was eleven; in all fourteen, being three less than the number reported in the previous year. As required by law, a sufficient number of warning placards, printed on cloth, was furnished early in the season to each railroad company operating in this state; also early in the autumn, enough copies of the following circular were furnished to the companies to enable them to supply a copy to each of their station agents, locomotive engineers and section men:

STATE OF MINNESOTA,
OFFICE OF CHIEF FIRE WARDEN,
St. Paul, Minn., Sept. 2, 1897.

PREVENTION OF FOREST AND PRAIRIE FIRES.

To Railroad Companies Operating in Minnesota:

According to the reports of Fire Wardens, the number of forest and prairie fires set in 1896 by railroad locomotives was seventeen, being fifteen less than in the previous year. However, there were seventy-four fires, the origin of which was reported as "unknown."

The fact that we have had a wet summer makes it more probable that the autumn will be dry. Section 12 of the Forest Preservation Act of April 18, 1895, provides: "In seasons of drouth railroad companies shall give particular instructions to their employes for the prevention and prompt extinguishment of fires."

With reference to the best spark arresters, it is understood that their degree of efficiency depends on the care with which they are maintained in good condition, and that this care rests primarily on the locomotive engineer.

Extra pains should be taken before dry weather to have rights of way cleared of combustible material. The great Hinckley fire of 1894 was caused by the carelessness of "section men" in burning over a right of way.

The following is a part of Section 12 of the above mentioned Act of April 18, 1895:

"It shall be the duty of all railroad companies operating any railroad within this state to use efficient spark arresters on all their engines and to keep their right of way to the width of fifty (50) feet on each side of the center of the main track cleared of all combustible materials and safely dispose of the same within said limits of their right of way between the fifteenth day of April and the first day of December. No railroad company shall permit its employes to leave a deposit of fire or live coals, or hot ashes, in the immediate vicinity of woodland, or lands liable to be overrun by fires, and where engineers, conductors or trainmen discover that fences or other materials along the right of way or woodland adjacent to the railroad are burning or in danger from fire, they shall report the same promptly at the next telegraph station that they may pass. In seasons of drouth railroad companies shall give particular instructions to their employes for the prevention and prompt extinguishment of fires, and they shall cause warning placards furnished by the Forest Commissioner to be posted at their stations in the vicinity of forest and prairie grass lands, and where a fire occurs along the line of their road they shall concentrate such help and adopt such measures as shall be available to effectively extinguish it. Any railroad company willfully violating the requirements of this Act shall be deemed guilty of a misdemeanor and be punished by a fine not exceeding one hundred ($100) dollars for each such offense, and **railroad employes** willfully violating the requirements of this section shall be guilty of a misdemeanor and be punished by a fine of not less than five ($5) dollars nor more than fifty ($50) dollars."

Under Section 9 "any person" who carelessly sets a fire which injures or endangers the property of another is liable to pay a fine of one hundred ($100) dollars or be imprisoned three (3) months.

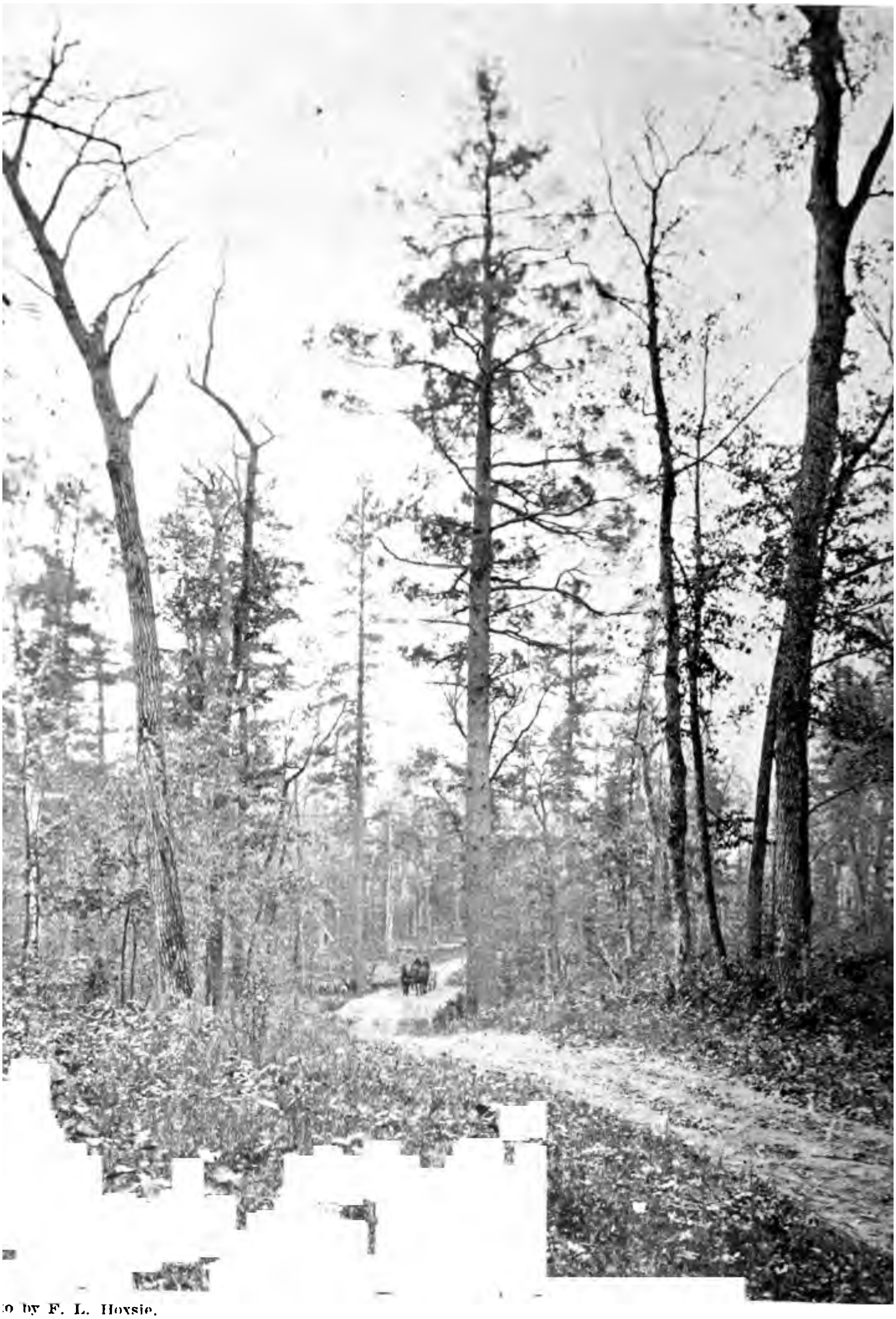
Several fires were caused by railroad locomotives during the dry spell last spring. If proper attention is given to this matter by all concerned it is believed that a marked improvement can be made in the record of forest and prairie fires caused by railroad companies.

Very respectfully,
C. C. ANDREWS,
Chief Fire Warden.

Injury Done to Soils by Forest and Prairie Fires.

In reply to an inquiry which I addressed to Professor Harry Snyder, chemist at the Agricultural Experiment Station, University of Minnesota (St. Anthony Park, Minn.), in regard to the injury done to the soil by forest and prairie fires, he replied by letter, dated the 17th instant, in which he states: "I do not think that our farmers, as a rule, are aware of the injury that results from fires." He also communicated to me printed bulletins containing his opinion on this question, from which I make the following quotation:

"Another source of loss of humus in the prairie and forest regions is the frequent burning over of the land. Soils covered with pine, in which sand largely predominates, frequently lose half or three-quarters their total nitrogen when visited by forest fires. The sand, being of an open and porous nature, aids in the more complete combustion of the humus. In the timbered regions of the Northwest the great forest fires of 1894 resulted in the average destruction of over 1,500 pounds



o by F. L. Hoxsie.

APPEARANCE OF THE WHITE PINE IN OPEN FOREST, MILLE LACS COUNTY.

of humus nitrogen per acre, to say nothing of the nitrogen lost in the burning of the timber. Analyses of soils, before and after the fire, made by the Minnesota Agricultural Experiment Station showed a loss in some cases of 2,500 pounds per acre of nitrogen, equivalent to a loss of 75 per cent of the total amount in the soil. The prairie fires have not been so destructive upon the humus as the forest fires, because the burning has been confined more to the surface. An average prairie fire, however, will remove more nitrogen from the soil than five ordinary crops of wheat."

Fire wardens should endeavor to disseminate such information as this in their respective communities.

COMPENSATION OF FIRE WARDENS.

Complaints have been received from a number of fire wardens that the county commissioners have refused to allow their accounts. It was with a view to economy and justice that the law authorized county commissioners to pass upon fire warden accounts. It was not deemed good policy to allow the town supervisors to pay themselves for their fire warden services, even though pay for such services is limited to fifteen days in a year at two dollars a day. Under the circumstances, for county commissioners to arbitrarily refuse to consider and allow the reasonable claims of fire wardens is not only exceedingly unjust to a class of men who, as a rule, cannot afford to give their time to the public, but tends to demoralize and prejudice the fire warden service. Such proceeding by county commissioners is against good example and against true economy. Quite a number of fire wardens have rendered their services without making any charge. Those who do present accounts for services should be duly paid. As the law limits the amount that a county may expend in any one year, under the fire warden law to $500 (one-third of which is paid by the state), there may be excuse for the county commissioners not approving fire warden claims until the end of the season and when it can be determined whether the five hundred dollar limit has been exceeded; but they are not obliged to wait until the end of the season. If any claims for services by fire wardens or those who assist in extinguishing fires are not found just and correct it is the duty of the county commissioners to disallow them. But it will be a great abuse of power if they refuse to allow those accounts which are correct and just. As a general rule, fire warden expenses in the various counties have aggregated but a small amount. The state is a large owner of vacant lands, and individual owners of lands contribute in taxes a large amount in the aggregate towards town, county and state revenues; and it is morally just that they should receive reasonable protection against the devastation from forest and prairie fires.

OPINION OF THE ATTORNEY GENERAL ON THE DUTY OF COUNTY COMMISSIONERS.

The following opinion of the Attorney General of Minnesota on the duty of the county commissioners with respect to fire warden accounts, was received by me on the 25th of June, 1897:

HON. C. C. ANDREWS,
Chief Fire Warden, St. Paul, Minn.,

DEAR SIR: I beg to acknowledge receipt of your communication of the 25th instant, in which you call attention to General Laws 1895, Chap. 196, and request to be advised, in effect, whether boards of county commissioners can arbitrarily refuse to audit the accounts of fire wardens; if not, of what remedy can the fire warden avail himself?

The Act in question was designed to provide for the protection of the forests of the state against fire, and imposes certain duties upon the various classes of officials therein named. Where a fire warden has been duly appointed, and in good faith performed the services under such appointment, he is entitled, as a matter of law, to the compensation provided by the Act. To be sure, the claimant is not entitled to payment until "he shall have presented an itemized account, and made oath or affirmation that said account is just and correct, which account shall be approved by the county commissioners, when satisfied of the justice of the claim, and left on file with the county auditor."

This implies examination by the commissioners, as in every other case which comes before them involving the expenditure of public moneys. If they decline to act at all upon such a matter, they can unquestionably be compelled to act by an appropriate proceeding, as for instance, by a writ of mandamus. No court will assume to control their discretion, but it can require them to entertain the matter and either allow or disallow the claim. General Statute 1894, Sec. 644, provides that "when the claim of any person against a county is disallowed, in whole or in part, by the board of county commissioners, such person may appeal from the decision of such board to the district court in the same county," and the procedure is therein expressly pointed out, as you will ascertain by reference thereto.

Generally, the bills presented by the wardens to the board of county commissioners are so small as to render it almost impracticable for the claimants to enforce their rights by judicial proceedings. It is not a question for the consideration of boards of county commissioners whether the law shall or shall not be enforced. The Act in question evidences the policy of the state in such regard, and a board of county commissioners which arbitrarily declines to recognize the bill of a fire warden upon the ground that they deem it inexpedient to enforce the law, would subject itself to very just censure. If a claim is valid, there is no question whatever as to the right of the claimant to enforce it, nor as to the ultimate outcome of his action.

It has been held by the Supreme Court of this state, in the case of Krushus vs. County of Houston, 46 Minn., 162, that on an appeal by the county from the decision of the county commissioners allowing the claim against the county, if the claimant recovered part of his claim, costs cannot be awarded to the county. It would follow that if the claimant should succeed in recovering any part of the amount disallowed by the board, he would be entitled to his costs.

It is greatly to be regretted that any board of county commissioners have assumed the position indicated by your communication, and it would seem that if you were to communicate with such board, apprising them of the character of the legislation in question, and the importance of the enforcement of the law, they might be willing to recede from so untenable a position. I am,

Very respectfully,
H. W. CHILDS,
Attorney General.

Press Reports of Forest and Prairie Fires in 1897 in Other States.

The following are telegraphic reports of serious forest and prairie fires outside of Minnesota in the autumn of 1897, as printed in the daily press of St. Paul, Minn., and which are inserted here to show the danger that existed in the latitude of this state:

[*From the Pioneer Press, Oct. 3, 1897.*]

PRAIRIES AFLAME.

BAD STATE OF AFFAIRS IN MANITOBA AND NORTH DAKOTA.

Winnipeg, Man., Special, Oct. 2.—Reports of great damage by prairie fires are coming in late to-night from some points. In both east and west telegraphic communications have been cut off by the fires. At Bagot station on the Canadian Pacific, the depot, two elevators and a number of other buildings were destroyed. A bank, hotel and Scott's stables were burned in this city to-night.

Ellendale, N. D., Special, Oct. 2.—A great prairie fire is raging southwest of here. Much apprehension is felt, as it seems to cover a wide territory.

Dickinson, N. D., Special, Oct. 2.—Destructive prairie fires have been raging north of here for three days. The Kildeer mountain has been burned over and many good winter ranges belonging to the large cattle outfits.

Rapid City, S. D., Special, Oct. 2.—The timber fires are still burning fiercely one mile north of Hill City. They have been burning four days. A strong wind is blowing from the north. Miners and citizens from Hill City are fighting hard to keep the fire from the city. It is one of the heaviest timber tracts in the Hills. The loss already amounts to thousands of dollars.

[*From the Pioneer Press, Oct. 5, 1897.*]

VICTIMS OF FIRE.

FATAL RESULTS OF THE FLAMES ON SOUTH DAKOTA PRAIRIES.

Miller, S. D., Special, Oct. 4.—Parties just in from twenty miles north state that as a result of the big prairie fire one man has died and three other people may die. Seven or eight were badly burned; one family of five, named Preston, all being in a dangerous condition. Hundreds of tons of hay, grain, etc., were destroyed. The fire was started by a man making a firebreak.

Jamestown, N. D., Special, Oct. 4.—Owing to the warm and dry weather of the past month, prairie fires have become very frequent and destructive during the last few days. There have been many serious losses along the east side of this county and the west side of Barnes county. Some of the farmers have lost all their grain and many have lost all their hay. Threshing is progressing very slowly, and it is feared that more serious damage from fires will follow unless rain comes soon.

Rapid City, S. D., Oct. 4.—Serious fires have been raging north and south of this place for four days, and the citizens are exhausted from fighting the flames. All night 300 men made a desperate stand against the line of fire approaching from the north. The fire had approached within two miles of Rapid City. It had been burning for four days in the heaviest timbered part of the Black Hills. It was swept toward Rapid City in a solid sheet of flame two miles wide. The woods and prairies are very dry, no rain having fallen here for two months.

St. Lawrence, S. D., Oct. 4.—A severe prairie fire in the north end of Hand county extended into Faulk county. One man will die from its effects, while four tramps, a woman, three children and a man living here are badly injured but will recover. A team of horses and quantities of grain and hay were burned.

[*From the Pioneer Press, Oct. 7, 1897.*]

FATAL FIRES IN ONTARIO.

Ottawa, Ont., Oct. 6.—Four bodies have been discovered near South Indian as a result of the forest fires. They are those of Mrs. Le Vielle, Miss Stiles, her sister, and Mrs. Le Vielle's two children, one an infant and the other twelve years old. The women rushed from their house to escape to the clearing, but the smoke surrounding them, they lost their way and ran into the flames. Had they remained in their dwelling house at South Indian they would have been perfectly safe, as it was not touched by the fire. A number of others are missing.

Two or three houses are all that is left of a once thriving village at South Indian. Two houses and a hotel are all that remain of Casselman. The village of Cheney is obliterated. Sixty of the most destitute were brought to this city this afternoon and the others are being provided for at farm houses and elsewhere. Each of the villages had about 500 inhabitants.

[*From the Pioneer Press, Oct. 10, 1897.*]

EIGHT MORE VICTIMS.

WOMAN AND CHILDREN AND A FARMER BURNED IN MANITOBA.

Winnipeg, Man., Special, Oct. 9.—Stories of the awful effects of the late fires still come in at intervals, the report of many fatalities which occurred at a distance having been delayed. The latest tale of horror comes from St. Anne. Mrs. Breanin, a half-breed woman, and her six children met their death on the Dawson road at the edge of the bush. The husband and father was away and it is probable that the poor victims fled panic-stricken from their home, only to be overtaken by the destroying element. Another case is that of a man named Teneau, a near neighbor of the Breanins, who was burned to death in his stable while attempting to save his horses. A farmer at Lorette lost everything he had, escaping barely with his life.

THREE GREAT FOREST FIRES IN THE NORTHWEST.

The most memorable forest fires which have occurred in the Northwest were those in Wisconsin in 1871, in Michigan in 1881 and in Minnesota in 1894. Forest fires raged in the northeastern part of Wisconsin in the latter part of September and first part of October, 1871, particularly in the counties on both sides of Green Bay. Four hundred square miles of territory were utterly devastated. Of several villages wiped out of existence the principal one was Peshtigo, with a population of 2,000, including those on farm lands in the vicinity, of whom one-third perished in the tornado of flame. On Sunday evening, October 8th, people in that town returning from church services heard "an ominous sound like the distant roar of the sea or of a coming storm," and in a few moments the horrible tempest of fire was upon them. Gov. Fairchild, in a proclamation, stated that the loss of life in the devastated district was at least 1,000; that 3,000 people were left entirely destitute; that mothers were left with fatherless children, fathers with motherless children, children were left homeless orphans, and distress and intense suffering were on every hand. Of private contribution for relief the sum of $166,789 had been received at the executive office alone at the end of 1871. The dam-

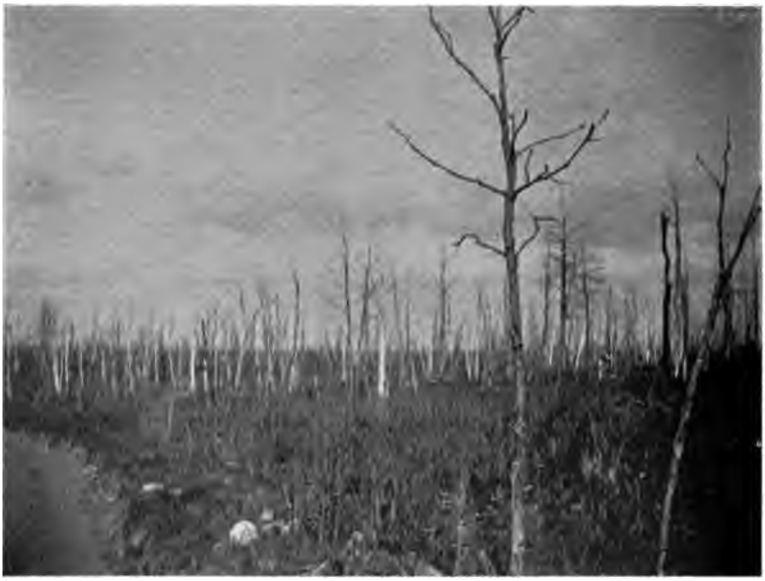


Photo by F. L. Hoxsie.

SECOND GROWTH OF FOREST ALONG RUM RIVER, BURNED OVER PREVIOUS TO 1895.

age caused by the fires was estimated at $3,000,000, not including that suffered at Peshtigo.

MICHIGAN FOREST FIRE, 1881.

The theater of the great forest fire in Michigan September 5th and following days, 1881, was in the broad peninsula between Lake Huron and Saginaw Bay, in the southeastern part of the state. The fire originated from burning brush in several places where settlers had cleared land, a frequent cause of fires, and, the weather being dry and a high wind rising, it acquired a force which no human agency could check. Forests and fields, farm buildings, orchards, crops and a number of small villages were laid in ashes. "So rapidly did the flames spread that live stock could find no place of refuge. The smoke was so dense that day was turned into night even at a distance from the burning forests, while at other times the whole heavens seemed in flames." The fire ran over forty-eight townships, a belt of timber country partly settled sixty miles in length, north and south, by ten to thirty miles in width, and comprising a million acres. The number of people who perished was 138. The value of property destroyed exceeded $2,000,000. Hundreds of families were burned out, and the money and supplies contributed for relief amounted to over a million dollars.

THE HINCKLEY FOREST FIRE, 1894.

During the drought, July and August, 1894, forest fires were common through the country from Pine county, Minnesota, north to Duluth; likewise in Wisconsin, and the atmosphere became very smoky. The village of Phillips, Wis., was burned by a forest fire July 26th; thirteen lives were lost and very much timber and other property in that and other localities destroyed. The great Hinckley fire originated about three miles southwest of Brook Park, Pine county, Minnesota, from railroad section men letting fires which they had set, to burn around bridges, get beyond their control, and which burned slowly for several days before the fatal fire. An eye-witness writes: "A strong wind from the southwest fanned the smoldering fires, which developed so great a heat as to immediately ignite green trees and buildings. In fact the atmosphere seemed to be heated to that degree that all inflammable material burst into a flame as soon as the hot wave struck it; thus trees and the whole sides of buildings immediately were in a sheet of flame." Saturday, Sept. 1, 1894, was a sultry day, and but for smoke would have been a clear day. The fire reached and destroyed the village and settlement of Brook Park at about 2 o'clock P. M., the wind then blowing a gale from the southwest. It then seemed "formed in a line about three miles long." Mission Creek was a station and village with a saw mill on the Duluth railroad three miles south of Hinckley. The fire reached and destroyed Mission Creek at 3 o'clock, the wind having been blowing "a hurricane" since 2 o'clock. Sweeping everything in its course, it reached and destroyed Hinckley about 4 o'clock. Of the pathetic scenes, the horror, the heroism, the unutterable distress and suffering which there occurred, it is unnecessary here to speak. The leading facts about the great Hinckley fire are that 418 people, being residents of that place and of the surrounding country, met death in an awful manner; that many of the inhabitants saved themselves by taking refuge in the so-called gravel pit, of three acres in extent and containing a small pond, in the outskirts of the village; that some hundreds more took refuge in Skunk lake, a short distance north of town, being conveyed thither by a railroad train that arrived from Duluth at the time of the fire, and which, having itself caught fire, was consumed by flames very soon after it reached Skunk lake. Its passengers and some of the Hinckley people, after temporary refuge in the lake, walked on towards Duluth and were met and taken thither by another train. Also, quite a number of Hinckley people were rescued by an Eastern Minnesota train, which arrived there at the beginning of the fire from Duluth and Superior.

The number of residents in the Hinckley burnt district, as registered by the relief commission, was 2,045. The material loss, but not including timber, sustained by the people, amounted to $750,000. The relief furnished to the sufferers through the relief commission, nearly all being from private contribution, amounted to $184,744.

As to Future Fires.

Some may ask, "Will there ever be another great forest fire in Minnesota like that of Hinckley?" I answer that there is an extensive forest region in our state that is yet uninhabited, but frequented by mineral prospectors, timber explorers, land seekers and hunters, and which, under the present limited fire warden system, cannot be watched. Our means for preventing forest fires in Minnesota are not as liberal and thorough as they are, for example, in Ontario, where mounted patrols are employed through dry seasons to guard against forest fires. Our Minnesota fire warden system should be expected to lessen the dangers of forest fires considerably, and has done so, as shown during the dry season in 1896 in the Lake Superior region, but it is not nearly as well provided and sustained as it should be. More especially are we unable to watch the unsettled regions. If in a remote forest locality some careless person leaves a fire, in dry weather, unextinguished, it may smolder for days, and then, being started afresh by a high wind, may spread in the solitude to uncontrollable proportions. So, also, great danger is incurred from new settlers persisting in burning brush in dry weather. These conditions render it important that people be educated to regard our forests as something worth caring for, and that a sentiment of extreme care in preventing forest fires be universally cultivated and respected. Even more than this, that a public sentiment be created which the lawless and stupidly negligent will fear, and which will make prosecutions and convictions practicable. The local press in the timber regions, I would submit, should do its part in creating such a sentiment.

The Minnesota Forests and Amounts and Varieties of the Wood and Timber Growing Therein.

Section 3 of the Forest Preservation Act makes it the duty of the Chief Fire Warden to "investigate the extent of the forests of the state, together with the amounts and varieties of the wood and timber growing therein," and to include such information in his annual report. My first and second annual reports contained estimates of standing timber by counties, and it does not seem necessary to repeat the information in this report. I subjoin, however, the following:

SUMMARY.

The estimates for twenty-three forest counties foot up as follows:

Land (acres)	22,855,000
Forest (acres)	10,889,000
White pine (feet)	16,849,000,000
Norway (or red) pine (feet)	3,417,475,000
Gray (or jack) pine (feet)	640,000,000
Ash (feet)	126 100,000
Basswood (feet)	491,000,000
Birch (feet)	706,000,000
Cedar (feet)	1,010,500,000
Elm (feet)	216,000,000
Maple (feet)	178,000,000
Oak (feet)	700,000,000
Poplar (feet)	475,000,000
Spruce (feet)	1,050,000,000
Tamarack (feet)	450,000,000
Ash, basswood, butternut, birch, elm, maple, poplar, spruce, tamarack, etc., not included in separate estimates (feet)	911,500,000
Wood (cords)	97,480,000

The estimates of the auditors of twenty-nine other counties, which contain more or less hardwood forest, show an aggregate area of 656,000 acres of natural forest, containing 6,000,000 cords of wood; also 45,000 acres of artificial forest, containing 67,000 cords of wood. Twenty-seven other counties, of which some are the oldest settled and some are mostly prairie, may be estimated as aggregating 345,000 acres of natural forest, with 3,450,000 cords of wood; also, aggregating 15,000 acres of artificial forest. The total area of natural forest in the state, according to the foregoing figures, and not including mere brush and swamp land, is 11,890,000 acres.

SOME FORESTRY FACTS AND PRINCIPLES.

The value of the pine, just as it stands, that is cut in Minnesota in a single winter, in a favorable business year, is $5,000,000; when sawed into lumber at the mills, its value will have increased to $10,000,000, of which increase 80 per cent, or $4,000,000, represents labor; when further manufactured and worked up in various forms its value becomes multiplied. This partly illustrates the value of our forests as an industrial resource. The friends of forestry do not interfere with the cutting and marketing of timber. On the contrary, they wish the industry to be continuous, and a great step in making it continuous is the prevention of forest fires, thereby promoting the natural reproduction of forest on cut-over land. The friends of forestry concede that the private owners of pine land have a right to, and for their financial success must, cut and sell their pine whenever they can find a good market for it. If there are forest areas which the public needs to have kept as forest—for example, at the head waters of rivers to help maintain water flow, or near some beautiful lake for scenery and health—then the public must buy it. The private owners cannot be despoiled of it without remuneration. No! the friends of forestry do not interfere in any way with the rights of lumbermen and owners of timber land. On the contrary, their work increases the value of the lumbermen's property. And inasmuch as the primeval pine will be about exhausted in the course of twenty years, the lumbermen themselves should become active supporters of forestry, do all they can to protect the young timber, encourage timber planting on non-agricultural lands and thus seek to maintain and perpetuate the lumber industry in our state.

Many of the countries of Europe derive a good share of their prosperity from forestry. In Germany 1,000,000 people are supported by forestry, and 2,000,000 more by manufactures of which forest products form the principal material. The little Duchy of Baden, not as large as Pine county in this state, derives a net annual revenue of $667,000 from its 240,000 acres of public forest. The Kingdom of Wurtemberg, only a very little larger than our county of St. Louis, derives a net annual revenue of $1,700,000 from its 418,000 acres of public forest.

The Kingdom of Saxony—which leads all other countries in forestry—from its 430,000 acres of mostly spruce forest, and mostly on poor mountain land, derives an annual net income of $1,900,000, being $4.50 per acre. And she is not exhausting her forests. On the contrary, her forests are worth double to-day what they were forty years ago.

The forests of all these countries are not only profitable in a money sense, but they are provided with good roads, are well guarded, are delightful resorts, and not the slightest impediment to the settlement and cultivation of neighboring agricultural lands.

LEADING PRINCIPLES OF FORESTRY.

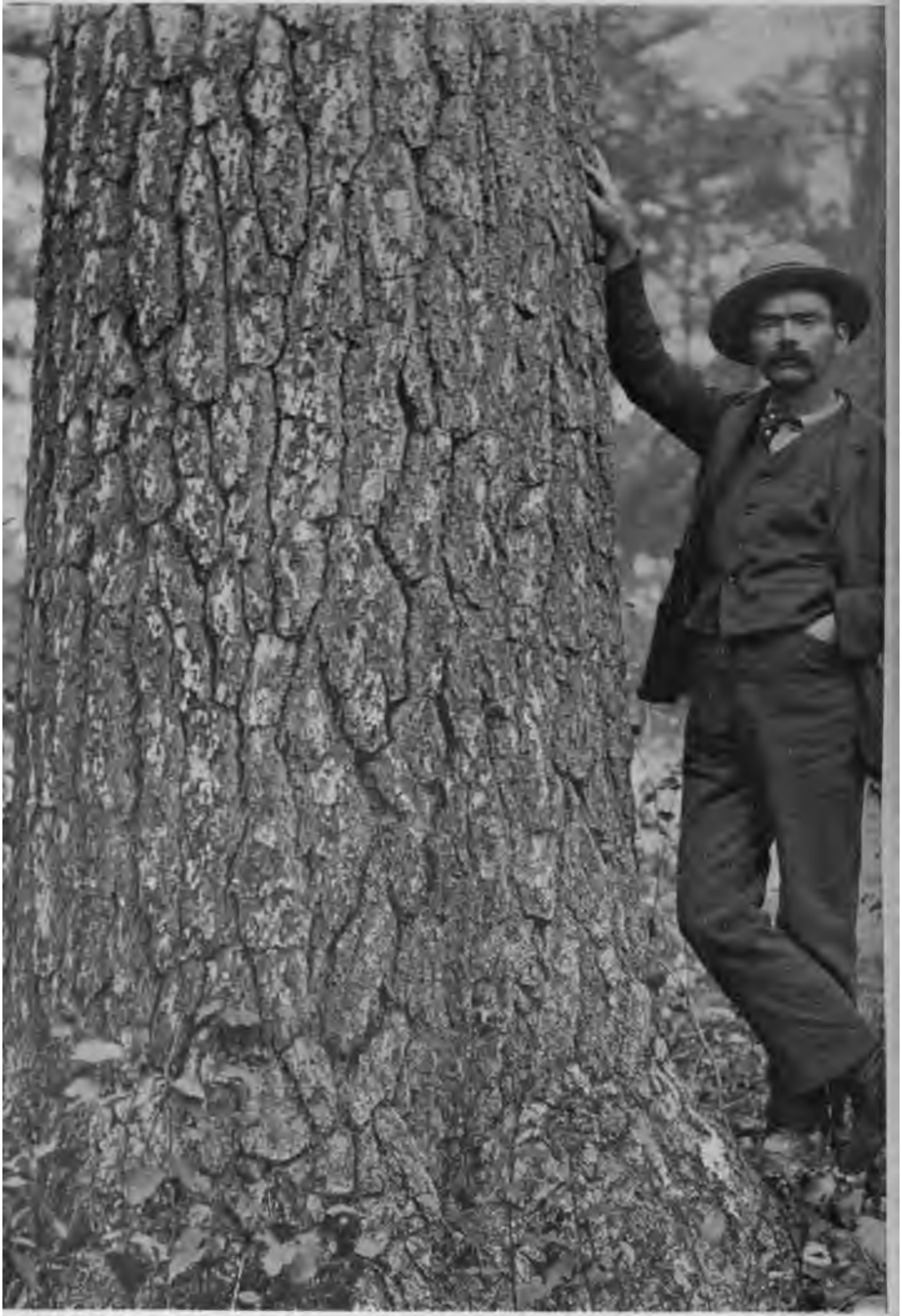
Some of the leading principles of forestry ought to be and easily can be understood by people generally. One of these principles is that the best agricultural land should not be devoted to forest; but that forest should be grown on land that is either too hilly, too rocky or too sandy and light for profitable agriculture. One of the great economic advantages—one of the great beauties so to speak—of forestry is that wood and timber can be profitably grown on soil that is unfit for farming purposes. The forest, by the leaves it sheds, continually enriches the soil; whereas, field crops exhaust it. Let this principle be remembered, that forest is not to appropriate good agricultural land. Whereever there is land now occupied by forest that is well suited to raise field crops it is expected that such land will finally be cleared and used for agriculture. It is, however, a fact, as has been shown by the experience of farmers in the older states, that much forest land is often cleared and put into field crops which is altogether too light and unfit for agriculture, but which, if left in forest, would continue to yield a good income. Farmers before clearing woodland should dig into and examine the soil. They should look ahead and remember that there is going to be a continually increasing demand for timber.

Another principle in forestry is that the forest must be continuous; that it should always furnish a sustained yield; that no more timber should be taken out of it in a year or in a series of ten or twenty years than grows in the entire forest the same period; so that in a hundred years hence as much can be cut in a year as can now be cut in a year. The forest is to be treated as an inviolable capital and only the interest or income taken from it. Let us take this simple illustration: Suppose one owns 2,000 acres of pine forest which he wishes to maintain as a perpetual income-yielding forest property, he will, according to forest principles, cut on an average only 20 acres a year, taking the ripest and largest trees, and so as to promote reproduction on the cleared land by natural seeding from trees left standing. But if for a series of years the market for lumber is very favorable he may cut a good deal more than 20 acres per year, then, in a series of years of poor market, he probably will not cut any, but he will manage so that for a long period his cuttings will average 20 acres a year. At the end of 100 years' rotation the 2,000 acres will have been all cut, and whoever has the forest then will resume the cutting on the 20 acres that were first cut, and which by that time will have grown to large size. This explains briefly the method of maintaining continuous and regular forest revenue, which is the fundamental principle of forestry. It is well to notice here a great advantage which the forest crop has over the wheat or any other field crop. The latter must always be harvested and marketed when ripe, however poor the market may be, but a forest crop can be left continually growing till the market is favorable.

Another principle of forestry is that the cutting of timber should be in blocks or strips so as to facilitate reproduction of timber on the cleared areas by seeds falling from the trees left standing. This is a more economical way of reforesting than by artificial sowing or planting. Sometimes, however, there is need of artificial help in preparing the land for the seed or in planting or sowing here and there a patch to effect a sufficiently dense growth.

Another principle is that a forest when young must have, in numbers, vastly more trees than when it is mature. A tree grown in the open may be handsome and useful for shade, but it is useless for timber. To make good timber, a forest, when young, must be crowded so as to secure height growth. In such situation there is a survival of the fittest. A struggle—a continual battle—goes on for supremacy, just about as in a human life. The weak ones succumb and perish; the strong ones tower aloft. In dense young forests the trees shed their branches or scarcely have any except near the top, and there is a lofty height growth of clear timber. A piece of mixed woods, managed on forestry principles in the Black Forest of Germany, has per acre at the age of 20 years, 3,960 trees; at the age of 40 years, 1,013 trees; at the age of 60 years, 449 trees; at the age of 80 years, 346 trees; at the age of 100 years, 262 trees. The decrease is sometimes partly effected by artificial thinning.

The fact is recognized that the most of the pine forest in Minnesota is now owned by private parties, who must, for their financial success, cut and sell their timber just as fast as they find a good market for it. In frequent cases they have built branch railroads into their forests, which they must take up as soon as the cutting and hauling are done. Hence they cut clean, even though some of the trees are not more than a third part grown. The practice is sometimes different in pineries bordering water courses, which afford a permanent cheap means of getting the logs to mill. In such pineries the proprietor can leave the younger trees



by F. L. Hoxsie.

ION OF A WHITE PINE TREE FOUR FEET SIX INCHES IN DIAMETER, NEAR *THE* VILLAGE OF COVE, MILLE LACS COUNTY.

to grow, and he can come back for them after an interval of some years. With the magnificent remnant of primeval pine the state has nothing to do except to aid in preventing its destruction by fires (and which in honor it is bound to do, since the pine land owners pay taxes for the protection of their property); or possibly the state should, before it is too late, buy and hold a few tracts of this virgin pine for parks.

Our best white pines have been growing from 100 to 200 years; and although merchantable pine, but not of the best quality, may be grown in 60 years, there are but very few individuals willing to wait so long for a crop; and if anything important is to be done to renew and perpetuate our forest wealth, it must be done by the state, or through the inducement it offers through the reduction of taxes or in some other form.

The Foresting of Waste Lands.

It is more profitable to raise forest from natural seeding, but where land has been entirely cleared, forest of pine and spruce can be renewed only by artificial planting or sowing. There are in Minnesota several million acres of waste land unfit for agriculture, and now totally useless, but which might be made to yield a rich revenue to the state if planted with forest.

The celebrated Scotch forester, Mr. James Brown, in his great work, "The Forester" (the fourth edition of which was published 27 years ago), states it as a general rule, verified by his own experience in England and Scotland, "that land which is from various causes unfit for high farming, will, under wood, at the end of 70 years, under good management, pay the proprietor nearly three times the sum of money that he would have received from any other crop upon the same piece of ground." He cites numerous instances of pine and larch crop that grew to a value, in 70 years, of $500 and upwards per acre, being an increase of over $7 per year. The most recent English writer on forestry, Dr. William Schlich, in his Manual of Forestry, says that it pays 2½ per cent compound interest per annum to plant Scotch pine on land of third quality, provided the land can be purchased for $62 per acre. In a recent most interesting and valuable address on "Forest Finance," by C. A. Schenck, Ph. D., superintendent of the forest department on Mr. Geo. W. Vanderbilt's estate at Biltmore, N. C., it is shown that, computing from the yield tables for German spruce, a plantation of spruce made on abandoned farm lands or cleared wood lands in this country, will contain, when 60 years old, about 45,000 feet (board measure) per acre, worth standing not too far from market, about 3.63 per 1,000 feet; or for the whole acre's crop, $163.39. The cost of planting an acre with spruce on the Biltmore estate he has found to be as follows: Three thousand plants per acre, two years old, $5; planting in plow furrows about three feet apart, $8 per acre; miscellaneous expenses, such as tools and supervision, $2. In all, $15 per acre. "Of these 3,000 plants about 500 will attain an age of 40 years, and about 300 an age of 60 years." This capital of $15 will amount in 60 years, at 3½ per cent compound interest, to $118.20. But there are a few other items of expense incident to the production of this acre of spruce; namely, taxes on the land estimated at 3 cents per annum, amounting in 60 years to $5.89; interest at 3½ per cent on the value of the land, say, $4, 14 cents per annum, amounting in 60 years to $27.51. Where planting is done on a large scale, the employment of a watchman or ranger will be necessary, with salary, say, $600 a year. "Ten thousand acres is a good sized range, and thus the expense for watching per acre per annum will be about 6 cents, and will amount in 60 years to $11.79." These three items together, of taxes, interest on value of land and expense of watching, amount to $45.19, which, added to $118.20, gives the sum of $163.39—being the same as the estimated value of the timber grown in 60 years on one acre.

This example shows that plantations of forests systematically made in this country on a large scale will net 3½ per cent on the capital invested. Certainly they ought to net that rate of income where the land cost practically nothing, as in the case of lands acquired by the state for non-payment of taxes. In planting a thousand acres with forest at the rate of expense specified by Dr. Schenck, $9,000 would be expended for labor. Dr. Schneck, who is an accomplished practical forester, lays down this rule: that making plantations of forests pays "where the aggregate expenses for plants, planting, supervision, interest on real estate, taxes and protection, accumulated with compound interest may be expected to be less than the expected yield or stumpage," and he insists that such investments of capital are safer than in savings banks, and more profitable than the best government bonds. Two inferences, he says, may be derived from the examples given: "First, that only such people should invest money in forest plantations as can get along without cash returns from the investment for a number of years; second, that there is nothing in the world yielding compound interest so regularly and surely as forestry, and therefore forestry is the best savings bank."

The State of Minnesota holds about 200,000 acres of land which was forfeited for non-payment of taxes, and which, at present, is of no use to any one. Probably there are 3,000,000 acres of land in the state, in scattered areas, that is unfit for agriculture, and upon which, in its present situation, no taxes will ever be paid. Much of it is now held by the general government, which, no doubt, would relinquish its title to it to our state on its undertaking to utilize it in a systematic manner for forestry. The most of it, without doubt, will produce white pine, or some other sort of profitable timber. It is utterly out of the question for individuals to plant this waste land with forest; but the state can do so, and if it would, what a magnificent patrimony it would possess. To those who have not considered the subject the beneficial results of foresting our waste and non-agricultural lands will seem incredible. Fifty years ago who would have believed that the proceeds of our state school lands would now amount to the princely sum of $13,000,000, yet such is the splendid fact.

Forest Maintains Water Supply.

Fifty years ago the American naturalist, Henry D. Thoreau, writing in "The Maine Woods," said: "The primitive wood is always and everywhere damp and mossy, so that I traveled constantly with the impression that I was in a swamp." Again he says: "The surface of the ground in the Maine woods is everywhere spongy and saturated with moisture." This country has not produced many wiser or more learned men than George P. Marsh. From his boyhood he was acquainted with the woods, and in his "Man and Nature," he repeatedly maintains that the forest is the great reservoir of moisture in expressions like the following: "The protection afforded by the forest against the escape of moisture from its soil, insures permanence and regularity of natural springs, not only within the limits of the woods but at some distance from their border." He quotes William Cullen Bryant as saying: "Fifty years ago large barges loaded with goods went up and down the Cuyahoga river; now in an ordinary stage of the water a canoe or skiff can hardly pass down the stream." That veteran advocate of forestry, Mr. Joseph B. Walker of New Hampshire, wrote in 1893: "The most important and valuable function of the White Mountain forest region is its office as a great natural reservoir for the storage and distribution of water." Dr. William Schlich, formerly Inspector General of forests to the government of India, and who for twelve years has been the principal professor of forestry at the Royal Indian Engineering College, Cooper's Hill, England, in the first volume of his Manual of Forestry states that forests "help to regulate the water supply, insure a more sustained feeding of springs, tend to reduce violent floods, and render the flow of water in rivers more continuous." Indeed everyone who has been in a forest knows that its soil is more moist, soft and porous than that of bare land. The roots of the trees and the layers of mould formed by the decomposed leaves serve as a natural reservoir, calculated to retain a large quantity of rain and admit of its gradually supplying the little rivulets which go to form brooks and rivers, and thus for a long time maintain the supply of water in rivers for navigation, for water power and for fertilizing contiguous soil. On the other hand, water that falls in heavy rains on cleared hillsides rushes down tumultuously, washing away the soil, tearing away bridges, undermining roads, and sometimes inundating towns and destroying life. On account of the great influence of forests in maintaining and regulating water supply in streams, it is now recognized in all countries as a sound principle that the state should own or at least control forests on the head waters of important rivers. Such ownership or control, however, is not, as a rule, inconsistent with a regulated cutting of merchantable timber, because a regulated cutting implies cutting with a view to care of young trees, natural reproduction and a continuation of the forest. This is a leading principle of forestry, which ought to be well known by the public and seasonably acted upon by the legislature. The economizing of our water power is a matter of first rate importance.

Minnesota is having experience similar to that of New York in the diminished flow of rivers. In 1884 the State of New York appointed a commission, of which Prof. Charles S. Sargent was chairman, to investigate and report on the preservation of the Adirondack forests. They made a careful report January, 1885, and among other matters which they discussed was the influence of those forests in maintaining the supply of water in important streams, and as their observations are applicable to the important rivers in Minnesota, which have their sources in our northern forests, I quote from their report as follows:

> The most important function of the Adirondack forests is found in the influence which they exert upon the streams heading among the hills of the Adirondack plateau, which distribute the heavy rainfall of this region. As reservoirs of moisture these forests are essential to the continued prosperity of the state; as such they are properly an object of interest to the whole community. Their influence is felt far beyond the limits of the state, and their destruction must be followed by widespread commercial disaster.
>
> The Hudson river, born of many mountain streams, flows in rapid course down the steep southern slopes of the Adirondack mountains. The Mohawk is largely fed by the streams in the southwestern portion of the plateau. Many streams, important to the people of the state, in the aid they bring to great industrial enterprises, although of less general importance and far-reaching influence than the Hudson or the Mohawk, flow out from the Adirondack forests to the St. Lawrence. It is not necessary to discuss here the question of the influence of the forests upon the flow of rivers. Science long ago pronounced upon this subject, which now, moreover, seems to be fully understood in all its bearings by the people of this state. The future of the rivers which flow from the Adirondack plateau may be judged by their past. Great changes have been noticed in these streams since the area of the Adirondack forests has been materially reduced. All the testimony which the commissioners have been able to collect upon this subject indicates that the summer flow of the Adirondack rivers has decreased within the memory of men now living from 30 to 50 per cent. Many of the small streams, which a quarter of a century ago were abundantly supplied with water during the entire summer, are now usually dry during many months. It is reported by competent observers that the flow of all the Adirondack streams becomes uncertain and irregular every year, and that the damage from spring floods and summer droughts is increasing. This is the effect of forest destruction in the past. The evil may be expected to increase under the existing condition of affairs more rapidly in the future than it has increased in the past.

Around the tributaries and headwaters of the Mississippi, Rum and St. Croix rivers, lumbering has been carried on for the past fifty years and the volume of water in these and other streams has diminished in consequence of the clearings. This New York report is about as applicable to our

Photo by F. L. Hoxsie.

POKEGAMA FALLS, MISSISSIPPI RIVER; A PART OF THE U. S. RESERVOIR DAM IN SIGHT, ITASCA COUNTY.

condition as if it had been made under the authority of our own state.

Forestry in the Public Schools.

If the pupils in the public schools could be made acquainted with the leading principles of forestry it would help to form a most useful public sentiment on the subject. Teachers have been willing to impart such information, but they have not always had it at hand in convenient form. It was partly to supply such a lack—and rather as a diversion and recreation than as a new study—that Professor Samuel B. Green, of the University of Minnesota, by request, furnished his "Outlines of a Few Lessons in Forestry," as a paper before the county superintendents of schools at the meeting of the State Educational Association, last winter. These lessons will enable a teacher, in an easy and pleasant way, to interest pupils in the great truths of forestry, which so deeply concern the welfare of our state; and believing that an intelligent public sentiment in regard to our forests will promote the exercise of care in preventing forest fires, I, with the approval of the State Superintendent of Public Instruction, furnished, through county and city superintendents, each public school teacher with a copy of Professor Green's lessons in season for Arbor Day, and in form of the following circular:

C. C. Andrews, *Chief Fire Warden.*	R. C. Dunn (State Auditor), *Forest Commissioner.*

Circular No. 10.

STATE OF MINNESOTA,
OFFICE OF CHIEF FIRE WARDEN,
St. Paul, Minn., Arbor Day, April, 1898.

The following paper is published, with the consent of its author and with the approval of the State Superintendent of Public Instruction, who regards it as strictly in line with the elementary science work now being done in many of our best schools, for the information and use of teachers of public schools, who are requested to have it preserved as a part of the permanent records of their respective schools.

Very respectfully,
C. C. Andrews,
Deputy Forest Commissioner and Chief Fire Warden.

OUTLINES OF A FEW LESSONS IN FORESTRY.

By Samuel B. Green,

Professor of Horticulture and Forestry, University of Minnesota.

Read before the County Superintendents' Section of the State Educational Association, 1897.

I recognize the fact that our rural schools are often much behind in the instruction given in reading, writing and arithmetic, and that these studies must receive the first attention of the teacher. But I think very often that these essentials would be taught very much better if the teacher were able to interest the pupils in the every-day changes that are going on in nature in their immediate vicinity. This is nature study, and I regard it, when properly taught to children, as a recreation and in no sense an increased burden, since children are naturally interested in such matters. It is under this head that I would put forestry and ask a few moments to call your attention to some of its claims to your consideration.

Forestry includes directly the study of the laws that govern the growth of trees, their application and the consideration of all the factors that enter into the growing and marketing of a crop of trees and indirectly it deals with the effect of forests on water supplies and on climate. This makes it a study of much breadth and importance, but here I wish to discuss only the possibility of teaching a few of its simplest and most evident phases. However, before I refer in detail to this matter I wish to call your attention to some general features with the forestry situation in this state.

We have here two forest problems; one of which concerns the profitable management of large areas of valuable timber trees, and the other the planting of windbreaks and shelter belts on our prairies.

Much attention has been given to the study of the best kinds of trees, and the best ways of planting and caring for trees on the prairie, and even though this matter is still in a very crude state, considerable progress has already been made.

But the problem of the management of our timber lands to get the most out of them has never received much attention in this country and we are, generally speaking, working our forest resources as we would a mine; that is, as though they could never be renewed. It is not entirely the fault of our lumbermen that such a condition exists, but it is largely due to our people having incorrect ideas of the rate of increase on growing trees and to their careless use of fire. The lumbermen have studied this problem and have concluded that it will not pay to hold their timber lands for a new growth because of the danger of its being destroyed by fire. On account of this great risk large areas of cut-over land have reverted to the state for taxes and are now almost entirely uncared for and yield nothing to the state or individual. I estimate the area of this class of land in this state at close to 3,000,000 acres. In St. Louis county alone it amounts to at least 427,099 acres. Such land is either too poor for farming or will not be needed for farming purposes for many years.

Again, the State of Minnesota owns or will own when the surveys are completed about 3,000,000 acres of land, the most of which is timbered. But no care is taken to get the most out of this for the benefit of the public school children for whom it is largely held, except that of late years the state auditor has been looking after cases of theft. Some of this land has a young growth of pine on it that if protected from fire would earn 20 per cent per year for twenty years, yet such pine has been sold and the returns invested in bonds bearing 3 per cent.

I know a school section which to-day is considered almost of no value. It is covered with a young growth of pine overtopped by aspen. If it continues to increase for the next twenty years as it has in the past, and this is a reasonable expectation, the timber on it will then be worth $102 per acre, and yet the chances are it will never be cut unless proper precautions are taken to protect it from fire.

Until the forest fire law of 1895 was enacted we had no adequate law to prevent forest fires, although fires had destroyed far more timber than the lumbermen had ever cut. And we should not have gotten the law at that time but for the terrible and entirely preventable Hinckley fire, wherein over 400 people lost their lives and an immense amount of valuable property was destroyed. This law has had a most excellent effect in preventing fires and is often referred to in other states as a model law, and yet there are many well-meaning people who think it of no importance.

But such lack of proper management of our forest resources, although about as good as that of any of the states west of New York, is evidence of a lack of knowledge of its possibilities for yielding a continuous revenue.

It has seemed to me that I could best give you an idea of the practicability of doing some elementary work in forest instruction in our public schools by citing some twenty subjects for lessons that would bring out a few of its most essential features:

LESSON I.

Characteristics of Some of our Common Trees. In some of our district schools a little attention is now being given to the subject of elementary botany. It seems to me that the botany of our trees could be made more interesting if it were supplemented by the study of the value of a tree for ornament, for fuel, etc.

Suppose that the lesson was on the Soft Maple; study the leaves, twigs, and other parts as is now done but in addition, let each pupil make inquiries of friends about the hardiness of the tree and the value of its by-products. It would be found that the soft maple grows naturally on river bottoms and attains the largest size on land that is occasionally overflowed, but that on high prairie it is likely to suffer from drought. The seeds ripen in June, are large, have a wide wing to aid in distribution, and grow if planted as soon as fallen. The wood is rather hard when dry and makes good flooring and summer fire wood. Maple sugar can be made from the sap, but twice as much sap is required as from the Sugar Maple to make the same amount of sugar. The tree is likely to be broken in the branches if growing in an exposed place. If pruned occasionally, this would not happen, because the shorter branches do not exert the leverage of long branches. Similar lessons could be given on any of our trees.

LESSON II.

The Willow could be studied and the pupils would gladly look up the different kinds in the vicinity and perhaps could find out the common names of them. In the prairie sections, the White Willow is very desirable for a windbreak, as it is hardy against drought and cold and grows easily from cuttings. A scholar whose parents had had some experience in raising willows might be given the privilege of reporting on the best methods of growing them. The trees are often liable to the attacks of the saw-fly which eats off the leaves. This might lead to a short study of this insect and methods of combatting it, many of which are well known.

The lack of information about trees among our people is well illustrated by the experience this summer of one of the teachers in charge of a summer school who told me of an instance where the owner of land near a highway had grubbed out some large Bur Oak trees in front of his house, and planted Box Elder trees seven feet high in their place. It seems almost incredible that a man would grub out a fine Bur Oak and plant a Box Elder in its place. The former is significant of long life and endurance, while the latter, though a good tree, is comparatively short-lived and not nearly so stately nor so hardy. It seems to me that it would not be difficult to give correct ideas on such matters in our schools.

LESSON III.

Benefits of Properly Placed Shelter Belts and Groves. Several points may be brought out here; for example, protection from wind, thus lessening the amount of evaporation from soil to leeward. The results of some experiments to determine the comparative amounts of evaporation during winds of different velocities, showed that evaporation with the wind traveling at the rate of 10 miles an hour was 3.8 times greater than in a calm; at 20 miles it was 5.7 greater, and at 30 miles it was 6.3 times greater than in a calm atmosphere of the same temperature and humidity. Professor King has shown that a windbreak 20 feet high appreciably prevented evaporation for a distance of 300 feet. Windbreaks also protect from dust storms and from hot and cold winds. In this way they add to the comfort of the inmates of the buildings and make less fuel, food and clothing required. It is far more comfortable to work to the leeward of a windbreak in cold weather than out on the open prairie.

The snow is also held in place by windbreaks and prevented, under the shade of trees, from melting very rapidly, and in this way the snow water has a better chance to soak into the ground and feed our wells and springs.

The distance to which windbreaks protect to leeward should be made a subject of special investigation by the pupils themselves. They can easily get the information desired by noting the distance to which the snow is drifted by any object that obstructs the wind. Even a barbwire fence has an appreciable effect. The distance to which this influence extends is largely governed by the height of the obstruction. Investigations seem to show that a windbreak affects the force of the wind for from sixteen to twenty feet for each foot in height, and probably the pupils' observations would confirm this.

LESSON IV.

Disadvantages of Trees in Some Places. Treeplanters sometimes blunder by setting trees in improper places. For example, the planting of a windbreak near to the side of a roadway may drift the snow too much into the road. A windbreak on the north and west sides of a building, especially near doors, may be objectionable in causing a snowdrift where it is a great inconvenience. I know of one person who condemned all windbreaks after an experience of this kind in 1888, when he found it almost impossible to keep the snow away from his door. In this case, if instead of planting the windbreak so close, he had planted it 100 or 200 feet distant and set out a few scattering trees in the intervening space, he would have had no cause for complaint and would have received the full benefit of the windbreak. It would be well to have the same points in mind in planting a windbreak to the windward side of land wanted for early planting in the spring.

LESSON V.

The Functions of the Various Parts of a Tree. The pupils should be given a slight idea of the means a plant uses to get food; *i. e.*, that the roots take up water with mineral substances in solution from the soil and the leaves take in food from the air. These are assimilated in the leaves and supplied to the tissues of plant for growth. Several lessons could profitably be given on this subject.

LESSON VI.

Transpiration. An object lesson in estimating the amount of water given off through the leaves of a plant can be easily given. Get a young sunflower or other actively growing plant started in a pot; stop up hole in the bottom of pot, water well and cover the whole pot up to stem with rubber cloth to prevent evaporation from the soil or the sides of the pot. Carefully weigh the plant and then allow it to stand in sunlight until the leaves show signs of wilting. Weigh again and note that the difference in the two weights is the amount of water given off through the leaves of the plant. A large sunflower plant has been known to give off three pints of water in one day. Large Cottonwood trees may give off from one to two barrels of water a day during most active growth in hot weather. The trees on an acre of ground, while they give off less than agricultural crops, may transpire from 500,000 to 1,500,000 pounds of water during one growing season.

Another Object Lesson on Transpiration. Note where dew is formed at night. All the older physicists give as the origin of dew the cooling of the atmosphere which precipitates the water it cannot hold upon cool objects in the vicinity. While this has some truth in it yet it will not account for the greater amount of dew on the leaves of living plants. The attention of the pupils might be called to the fact that when walking through a field of stubble in the morning their shoes would be wet but very little, perhaps not at all, but in going through clover there would probably be a sufficient amount of dew to thoroughly soak their shoes. This water is brought from the ground through the plant tissues, is forced out through the cells, and is condensed by the cold air on the surface of the leaves. Stubble, which is dead, does not throw off water as clover, which is alive and active, with its roots penetrating into the subsoil, and so has but little if any water on its leaves.

LESSON VII.

The Seed, a Miniature Plant. To illustrate this, perhaps no better seed could be found than the Soft Maple when just starting into growth. It may also be shown in this or another lesson that no two leaves, twigs or branches of any tree are exactly alike and that plants are infinitely variable.

LESSON VIII.

Special Appliances for Distributing Seeds. Attention might be called to the seed of the cottonwood, which has cottony float on its seed which enables it to be blown great distances by the wind. The Elm, Ash, Box Elder and Maple have wings which answer the same purpose. Where Locust is found, attention could be called to the fact that the seed pods remain on the tree into the winter and that, when they open, the seeds are thrown quite a distance from the tree. The fruit of plums and cherries is often carried for a distance by birds or squirrels and after the pulp is eaten the seeds are thrown away. Pupils unconsciously distribute seed in the same way.

LESSON IX.

Effect of Slope on Tree Growth. In hilly sections, as along the bluffs of the Mississippi river, it could be plainly shown that a northern slope offers far better conditions for tree growth than the southern slope. The south sides of the bluffs are often entirely bare of trees while the north sides are generally thickly wooded. Some reference might be made to the comparative advantages of eastern and western slopes. The main reasons why the northern or northeastern slopes are the best might be given that they do not receive the direct rays of the sun, or the hot dry southwest winds, and therefore the soil does not dry out so quickly, the trees are not so liable to sunscald and seedlings start much more readily on them than on a southern or southwestern slope.

LESSON X.

Certain Trees Form their Flower Buds in the Fall. Illustrate by cutting off branches of Cottonwood, Aspen, Poplar, Soft Maple, Box Elder, Hazel or Willow in the winter or early in the spring; bring them into a warm room and place their stems in water. The flower buds will open in a short time. Note that there are two kinds of buds, leaf and flower buds. Note also that their growth is made after a branch is cut from the tree, thus showing that the branch contained a sufficient amount of stored-up food to start the buds into growth. A plant is not like an animal in that one part will not grow when separated from the whole.

LESSON XI.

Effect of Soil on Kind and Quality of Tree Growth. In sections where there is a variety of soil and elevations, a lesson might be given in studying the relation of trees to soil. This might be supplemented by inquiries made elsewhere. It would probably be brought out that willows and poplars grow on very wet soil, that the Black Walnut is found on moist, deep, rich soil and the Hard Maple on rich, clay soils of a rather open character. In the northern section it could be easily shown that White Pine grows on good soil and gets ahead of every other evergreen on that land. On rather poor land the Norway Pine would get ahead of the White Pine, and on very poor land the Jack Pine will crowd out either one. Bur Oak and species of the black oak class are often found on very dry, gravelly hills. These examples are sufficient to show that the growth of trees on land is a fairly good index to its value for agricultural purposes.

LESSON XII.

Effect of Trees on Land near them. It should be generally known that trees differ in the nature of their root systems. Some trees, such as Bur Oak and Black Walnut and to some extent the Maple and Ash, do not have many surface roots while the Cottonwood and Willow have a large number. On this account grasses or other crops will grow vigorously close to the trunk in the shade of a Bur Oak when they would not near the Cottonwood. The latter seems to take all the moisture and plant food out of the soil so that it is difficult for any of the better agricultural crops to survive near them. This was called to my attention recently in observing the yields from different parts of a field of potatoes. Under an Oak the potatoes yielded well nearly to the trunk while under the Cottonwood the potatoes were so small as to be of little value.

LESSON XIII.

Tree Trunk. Take the trunk of a tree for a lesson. Show how the wood grows by the addition of a ring on the outside each year and the bark grows by the addition of a ring to the inside each year; that the cracks in the old bark are the result solely of the tree outgrowing its old bark clothes. Show also that the new growth is spread over the entire surface of the tree and that the bark and wood of the roots, branches, branchlets and twigs are made up of annual rings. Note sapwood and heartwood and difference in color and explain that there is active sap flow in the sapwood and very little sap flow in the heartwood. Analyze a young tree trunk by cutting it up into sections showing the length of each year's growth and show then that each year's growth is conical in form. Note that the rings of trees vary in thickness and that they thus show the history of the tree. For instance, a very thin ring may indicate a very dry season or an attack of grasshoppers, caterpillars or other injury. It is often interesting to note the connection between such data and to compare the known age of trees with the age estimated by the number of rings.

LESSON XIV.

Products of the Forest. Some of these are lumber, fuel, wood pulp for newspapers and other purposes, cork, bark for tanning, maple sugar, spruce, gum, wild fruits and nuts, resin, turpentine, essential oils and various medicinal products.

This lesson may be divided and very much enlarged upon at the convenience of the teacher. The various uses of wood might be considered and each scholar be required to make out a list of the uses of wood and perhaps give a list of hardwoods and of softwoods.

LESSON XV.

Sunscald. Trees may be injured by sunscald. By this is meant the injury which occasionally results in killing the bark on the southwest side of trees. This is also a common cause of death to Apple trees, as was the case last year with many Basswood, Box Elder and Maples. In this lesson the teacher should call attention to the fact that such injuries are common and always occur on the southwest side of trees and only on those parts that are exposed to the sun. Where the trunk is shaded, as in forests, it never occurs. The remedy then is to shade the trunks and larger branches of our shade trees. If there were time it could be shown how this injury probably occurs and a lesson could be drawn with illustrations and original simple studies to show that one part of a tree may start into growth independently of other parts.

LESSON XVI.

Injuries to Trees by Fires. Explain that even small fires may injure the bark of trees although it may not kill them; that when fires occur in the spring they often destroy the young seedlings that are just pushing out of the ground; that they burn up the dead leaves and leaf mould which the trees delight in; that the careless use of fires in forests has destroyed many lives and an immense amount of property. Give the history of the conditions that led to the Hinckley fire of 1894, and of some very injurious prairie fires.

LESSON XVII.

Heat Absorptive Qualities of Differently Colored Substances. Note the way in which snow melts from around dark objects, such as stems of bushes, trunks of trees, etc. A good way to illustrate this is to melt a drift of snow by sprinkling dark colored earth over it on a clear day. This is a common practice among market gardeners to melt snow around hotbeds and buildings.

LESSON XVIII.

Where Trees are Most Abundant. Refer to the fact that forests are found skirting the sea line and following the larger watercourses over the entire earth; that the interior continental climates are dry and have treeless plains or deserts. This might be shown by maps of Europe, Asia, Africa, South America, North America and Australia. Show how within the boundaries of Minnesota is found, (1) the heavy timber lands; (2), the borderland of the great eastern continental forests with its scattered out posts of Bur Oak and Black Oaks and (3), the commencement of the great prairies where trees find great difficulty in keeping ahead of the grasses and sedges. Show also that trees follow the watercourses into the prairies in this state.

LESSON XIX.

Why Prairies are Treeless. It seems to be important to give correct ideas to pupils in regard to this matter, and a good way to show it is by reference to the previous lesson (XVIII) and then explain that there are places in western Dakota and in the foothills of the Rocky Mountains where trees cannot be grown because it is too dry for them, while in eastern Minnesota and Wisconsin the trees grow naturally. Between these two extremes there must be a section where a little assistance given in starting the young trees would aid in establishing a growth of trees. For this reason trees may sometimes be grown on prairies when planted and cared for where they would not grow if left to themselves. This could be illustrated in a small way by citing instances where woodlands skirt the streams and extend for a short distance into the prairies, where the soil is moist, while back from the river bottoms groves require some cultivation in order to have them do well. Attention should also be called to the fact that immense herds of buffalo once roamed the prairies and that the Indians burned the grass and the woods near the plains to make pasturage for the buffalo, and in so doing they to some extent forced the tree line eastward.

LESSON XX.

Trees for Prairie Planting. In too many instances tree planters on prairies have put out only quick growing, short-lived trees, such as the Cottonwood and Lombardy Poplar, and after fifteen or twenty years they have found their trees dying and nothing coming on to take their places. These quick-growing kinds are very desirable as a protection for the near future, but they are often short-lived and should never be planted alone. Among them should be planted a sufficient number of long-lived and perhaps slower-growing kinds to afford protection in later years when the short-lived kinds have died out. The soil and location have much to do in determining the longevity of varieties; for instance, the Cottonwood and Lombardy Poplar are generally short-lived trees in this section, but when planted in locations where their roots reach the permanent water level their period of life may be considerably lengthened.

In starting a grove or windbreak on the prairie in this section, there is probably no better tree to begin with than the White Willow. It is quick growing, rather long-lived in most situations, makes good summer fuel and renews itself very readily from the stump; the Green Ash would probably rank next as a pioneer tree. The White Elm is also very valuable for this purpose, but generally should follow the White Willow. The Cottonwood may sometimes, though very seldom, be the best tree to use, but on average prairie land it would be better if the White Willow or Green Ash were always planted in its stead, and the Box Elder is a much better tree for general planting. The Basswood is an excellent tree for prairie planting. After a good windbreak has been secured it is safe to plant out the hardy coniferous evergreens and such trees as the Mountain Ash, European White Birch and other similar ornamental trees. Wind protection is beneficial to all trees and necessary for many of our best ornamental kinds and often makes the difference between success and failure in growing them.

Distance Apart to Plant. In the planting of groves we should aim to get the land shaded by the trees as soon as practicable and to keep it covered with a canopy of leaves, but should cultivate thoroughly until this condition has been reached. The United States government recommended the planting of trees four feet apart each way with the idea that when so planted they would quickly shade the ground and consequently keep out grass and prevent extensive evaporation. Some successful plantings have been made on this plan, but when planted so closely together the branches grow into the rows after a few years and before they give sufficient shade to kill out grass cultivation

must be discontinued. In this section, where we have so much very bright, sunshiny weather, grass can grow under foliage that would kill it out in a more humid climate. This is especially true of such trees as the Cottonwood, Lombardy Poplar and White Elm when planted alone, as they have open foliage that does not furnish a dense shade. On this account, among those who have had large experience in prairie planting there has been a tendency of late years to plant two feet apart in rows eight feet apart and some of our most successful planters prefer even more room than this between the rows. When plantings are made 2x8 feet the same number of trees are required for an acre as when planted 4x4 feet, but the former distance has the advantage over the latter in that the space between the rows can be cultivated for perhaps ten years or more, by which time most trees will have formed a dense shade, be able to take care of themselves and keep out the grass. When a much greater distance than eight feet is allowed between the rows we generally fail to get forest conditions for many years and to that extent fall short of an important condition in prairie planting. The distances given here might need to be modified to suit different varieties and local climatic conditions.

EUROPEAN FORESTRY.

One of the best, though indirect, ways for preventing forest fires is the diffusion of popular information on forestry. When people know what forestry is, how precious in so many ways their forests are, and what great economic benefits may be derived from their management on forestry principles they will refrain more than they do now from causing fires. For this reason I have taken pains to procure and to submit here fresh and reliable information on forestry in some of the countries of Europe which have long and successfully managed their forests on forestry principles. I am much indebted, for information, to the heads of the forest departments of France, Prussia and Switzerland.

Germany in the past hundred years has created the science of forestry. She outranks all other countries in forestry achievements. Yet France is not so very far behind in splendid forestry work. It has been my fortune to travel through France four different times; first in 1869, again in 1875, in 1876, and last in 1882, at which time I passed over the route from Paris via Bordeaux to Lisbon, and was par-

Photo by F. L. Hoxsie.

VIEW OF THE SOUTH SHORE OF MILLE LACS LAKE;
HARDWOOD FOREST.

ticularly impressed by the extensive stretches of lofty, luxurient and most beautiful forest. Not a dead, burned, nor even deformed tree was to be seen. I rode for hours through forests; first through hardwood, the clean, dense and thrifty appearance of which I especially admired, and afterwards, towards the Spanish border, through pine. All indicated the best of care.

FRANCE.

The total extent of the forests of France (exclusive of the colonies) is about 23.500,000 acres, which represents about 17 per cent of the surface of the entire territory.

These forests are divided in: Forests of the state, 2,700,000 acres; forests of the municipalities and of the public institutions, 4,700,000 acres; forests of individuals, 16,100,000 acres. The forests of the state and those of the municipalities and of the public institutions are managed and supervised by the Administration of Forests. France only extends over 9 degrees in latitude, but, as it has very high chains of mountains, the result is that it possesses all the climates of Europe, from the hottest to the coldest, and that a great variety exists in the species of trees that compose the forests.

The principal varieties of these species are: In the warm region, comprising the borders of the Mediterranean sea and of the Gulf of Gascony, the Cork Oak (Quercus Suber); the Evergreen Oak (Quercus Ilex); the Cluster Pine (Pinus Pinaster) and the Aleppo Pine (Pinus Halepensis).

In the temperate region, comprising the plains, the rolling grounds and the lower parts of the mountains, the common European Oak (Quercus Robur); the European White Oak (Quercus Pedunculata); the Beech (Fagus Sylvatica); the Hornbeam (Carpinus Betulus); the common European Ash (Fraxinus Excelsior).

In the cold region, comprising the middle and upper parts of the mountains, up to the extreme limit of vegetation, the

Pectinal Fir (Abies Pectinata); the Norway Spruce Fir (Abies Excelsa); the Beech (Fagus Sylvatica); the Scotch Pine (Pinus Sylvestris); the Mountain Pine (Pinus Montana); the Larch (Larix Europea).

It should be noted that the beech is found at the same time in the temperate and in the cold regions. The Scotch pine, which belongs to the cold region, has been artificially introduced on large areas in the temperate region.

STATE FORESTS.

The total area of the forests of the state, 2,700,000 acres, is composed of 2,100,000 acres of productive forests and of 600,000 acres of protective forests, situated in the mountains or on the dunes of the ocean; of lands recently purchased by the state on the banks of torrents and whereon timber is now being planted.

The forests yield annually to the state:

Timber (cubic feet)	33,800,000
Fire wood (cubic feet)	62,300,000
Total	96,100,000

This represents nearly an annual production of 46 cubic feet of wood per acre of productive forest. The state forests produce in addition thereto oak bark, which is used in the tanning of leather; cork, rosin and several other small products; also hunting rights are leased.

The gross annual income in money is $5,500,000, or $2.62 per acre of producing forest. In some forests this average is largely exceeded and it attains as high as $8 per acre.

The expenses are as follows, viz.:

Labor	$1,240,000
Forest instruction	35,000
Sundry works	360,000
Reforesting ot mountains	700,000
Taxes paid to departments and municipalities	360,000
Sundry expenses	60,000
Total	$2,755,000

But of all these expenses, a large share is applied either in administering the forests of the municipalities or in executing works of real public utility in the "protection forests," or in reforesting mountain lands (to prevent slides and the like). If we make these several deductions we find that the expenses incurred in the producing forests do not exceed $1,500,000, or 71 cents per acre. The net annual income of these forests is therefore $2.62 less 71 cents, equal to $1.91 per acre.

The state forests are carried on either as high forest or as coppice, and are managed under regulations made by the President of the Republic. Cuttings are made yearly. In forests rich in wood there is cut every year an amount equal to the increment or growth; in forests poor in wood they cut less than the increment in order to gradually increase the forest. The endeavor is made also to increase the production of the timber wood by reducing that of the fire wood. The "high tree forests" are cut down at periods ranging from 120 to 150 years.

The work is directed in a way that will insure natural reforesting from the seeds that fall from the standing trees. Not only the trees that have attained the age determined by the rules are cut down, but also the dead ones and those which are dying and those that prevent the growth of neighboring trees. In temperate climate the annual cutting of high trees is on a limited area; a large number of trees are cut down simultaneously. In very cold climates and where winds are to be feared, only a few trees are taken away at a time on the same point and cutting is then done on a larger area.

The low forest, coppice and second growth are cut in rotations, ranging from 25 to 35 years. The reserved trees, which are very numerous, are cut on an average every 100 years, but some selected trees are allowed to attain and even pass 200 years.

The labor performed in the forests consists in the construction and maintenance of forest roads, water sawmills, houses for watchmen, replanting. Fortunately, owing to the system of culture now in use, artificial reforesting has but little importance in forests, properly speaking, but sowing and planting in the small open spaces, or on the points where a few more valuable species are to be introduced, or where the soil of the forest is better adapted to some varieties, there, sowing and planting are more frequent. The average cost of such work is $10 per acre.

Very considerable reforesting is made on mountain lands, where the state plants trees to regulate the action of the waters and stop the ravages of torrents. For that purpose $700,000 are expended every year, the largest part of which is used in the purchase of land, and the other part in dams to regulate the streams, and in plantations to settle and retain the soil. The state purchases yearly on an average 16,000 acres. The average cost of reforesting is $20 per acre, and $18 must be added thereto for work in improving the streams, building roads, etc. Planting is preferred to sowing on calcareous or chalky soil.

The administration of the forests forms part of the Department of Agriculture. It has charge not only of the direction and care of the forests of the state and of those belonging to municipal corporations and public institutions, but also the overseeing of the fishing in the rivers and creeks. At its head is a director, residing in Paris, who has under him: A central service composed of 3 administering general inspectors, 10 inspectors, 5 assistant inspectors and 17 clerks.

An exterior service composed of:

First—Personnel superior or of administration—32 forest keepers, 200 inspectors, 215 assistant inspectors, 250 general wardens

Second—Personnel inferior or of surveillance—3,500 fore- and wardens, paid by the state; 3,700 foremen and wardens, paid by the municipal corporations and public institutions.

The annual salaries paid are as follows:

SUPERIOR OFFICIALS.

Director	$3,000
Administrators	$1,800 to 2,600
Forest keepers	1,600 to 2,400
Inspectors	800 to 1,200
Assistant inspectors	600 to 800
General wardens	300 to 520

exclusive of some additional allowances for traveling expenses.

INFERIOR OFFICIALS.

Foremen and wardens paid by the state an average of	$160.00
Foremen and wardens paid by the municipal corporations and public institutions	116.00

The foremen and wardens receive in addition thereto allowances of firewood, tillable land, pasture grounds, etc.

Those in the employment of the state have free rent in houses built in the forest, or in lieu thereof they receive as compensation a cash equivalent.

The superior officials are entitled to a retreat pension at the age of 60 years, and the inferior officials at the age of 55 years.

France has three forestry schools. One school of higher instruction at Nancy; one school of secondary instruction and one school of primary instruction. The two latter schools are established in the department of Loiret, on the possessions of the administration at Barres.

FORESTS OF MUNICIPAL CORPORATIONS AND OF PUBLIC INSTITUTIONS.

The forests of municipal corporations and of public institutions comprise 4,700,000 acres. They are supervised by the Forest Service on the same conditions and according to the same principles as the state forests. They contain about 200,000 acres of forests for protection, and their producing area is thereby reduced to 4,500,000 acres. They produce annually, timber, 42,000 000 cubic feet; fire wood, 128,000,000 cubic feet, and together, 170,000,000 cubic feet. This represents nearly an annual production in wood of 38 cubic feet per acre of productive forest. The annua cash value of the product including the bark, cork and rosin is $6,400,000 or $1.42 gross income per acre. The net income is about $1.14 per acre. The forests belonging to the municipalities and public institutions are under regulations approved by the President of the Republic. These regulations and those of the state forests have been established with a view of insuring a continuous annual production and even of increasing that production in the forests where it is not yet sufficient.

PRIVATE FORESTS.

Private individuals are at liberty to manage their forests as they please. But they are prohibited from cutting and taking trees from forests which are necessary to maintain and regulate water flow, to protect lands against the encroachments of the sea and sands, to defend the territory, or which are necessary for the public health. The destruction of private forests has become rarer and rarer and the proprietors acknowledge now that on soils of poor quality the income from forests is greater than that from arable land. As a result the area of private forests, instead of decreasing, increases from year to year by reason of the timbering of lands on which agriculture pays but small profits.

The income from private forests in quantity and in money is not exactly known. It is, however, known that on the same area they pay less than the state forests. Private individuals in their anxiety to get returns are inclined to cut down the wood when it is too young, and in the forests where coppice wood is raised they do not leave a sufficient reserve and oftentimes leave none at all. One can notice, however, that the principles of Sylviculture are spreading more and more in the culture of private forests. The large forests are subjected to the same mode of management and are treated like the state or municipal forests. On the whole the annual production is regular and tends to become better in both quantity and quality.

Forest Fires.

In the temperate and in the cold regions of France, that is, in the larger portion of the territory, the fires are but few and cause slight damage. The long periods of drought are not frequent, the numerous roads that run through the forests make very good lines of defense, and the villages that surround the massive wooded areas furnish at the first alarm devoted laborers. The railroad companies, being held responsible for damage by fire caused by flying sparks from their locomotives, take particular care, and in exposed places cut the grass and brush along their roadbeds.

The forestry code forbids, under penalty of $4 to $20, carrying or lighting matches in or within a distance of 200 metres from the forests.

In the forest camps of the state, municipal corporations or public institutions, it is forbidden to the workers to light fire outside of the buildings or shops, the location whereof is indicated by the forest service.

In the warm region the dangers from fires are greater. As a preventative against them more roads are built, trenches 20 to 50 metres wide and kept free from grass and brush are made around the forest, along railroad lines, on the dividing lines between forests belonging to several owners, and also from distance to distance in the large and dense forests belonging to the same proprietor. The use of fire in forest camps and in agricultural camps situated within 200 meters from the forests, is forbidden during the months of June, July, August and September.

A special watch is organized, telegraphic lines penetrating the center of the forests admit of alarm of fire at its start and call for help. If the working force appears to be insufficient the military authority furnishes the deficiency and sends on the spot soldiers who act according to the directions of the forest service.

COLONIES.

France, fully convinced that the preservation of forests is in all lands of the highest importance, has organized a forest service in its possessions outside of Europe: In Algeria, Tunis, Madagascar, Indo-China, Reunion. In Algeria the organization is exactly similar to that of France and calls for an annual expenditure for salaries and works of $600,000.

The periodical on forests that has the largest circulation in France is the "Revue des Eaux et Forets," issued twice a month. It is edited by "J. Rothschild, 13 rue des St. Peres, Paris." The price of a yearly subscription for foreign states is $4. The Administration of Forests does not publish an annual report, but limits itself to furnishing to the public authorities the information that may be called for.

PRUSSIA.

STATE FORESTS.

The extent of the state forests of Prussia is 6,955,227 acres. Included in this, however, are 715,637 acres not designed for tree culture. In addition, the extent of forests belonging to municipalities is 2,563,812 acres; belonging to churches, 207,752 acres; belonging to corporations, 555,900 acres; private forests, 10,828,730 acres, making an aggregate extent of 21,111,421 acres in the whole kingdom.

The prevailing kinds of trees in the state forests are Scotch pine, larch, beech, red pine, fir and oak. The value of the land varies so much, rising from a small amount to $700 per acre, that it is impossible to give an average estimated value. The annual aggregate expense of administration (state forests) is as follows: The office expenses and maintenance, including expense for education in forestry, etc., averaged in the years 1893 to 1897, per annum $8.500,000. The annual aggregate revenue in the years 1893 to 1897 amounted to $17,200,000, being at the net rate of $1.50 per acre of actual forest. The number ot acres sown or planted with forest annually during the years 1893 to 1895 was 44,830.

The foresting of the beach is mostly effected from standing trees, though artificial sowing and planting are also done. The oak is either reforested by seed from standing trees or artificially through sowing or by planting. The Scotch pine is first cut clean and reforested by sowing or planting, and the red pine the same. Sowing from standing trees is not common. In regard to the continuity of forest products the forestry department endeavors to obtain the highest possible continuous net income. The usual method of cutting is in blocks clean.

Under the head of compulsory tree planting the following laws are referred to: The Forest Protection Law of July 6th, 1875; the law of August 4th, 1876, concerning the administration of forests owned by municipalities and public institutions in the provinces of Prussia, Brandenburg, Pomerania, Posen, Silesia and Saxony.

The average annual damage caused by forest fires in the years 1892 to 1896 was as follows: Totally or mostly destroyed, 2,992 acres; only slightly damaged, 117 acres; only the surface destroyed, 522 acres. The average annual number of forest fires in the years 1892 to 1896 was 36, the causes of which were as follows: 12 unknown, 2 railroads, 5 incendiary, 16 caused by carelessness, 1 lightning.

During the years 1892 to 1896 the annual average nun
of forest fires caused by railroad locomotives was 2.

The officers in the forest service are equal in rank tc
other high grade officers in the government service.
foresters have clerical rank. The salary of "Oberfore
(district manager) ranges according to length of se
from 2,700 to 5,700 marks. Unfavorably situated off
receive an additional amount, the maximum of which is
marks annually. In addition there is usually free resid
and fuel. The salary of the "Oberforstmeister" (chie
spector) is from 4,200 to 7,200 marks, according to leng
service, which is calculated from the time of qualific
for the office of "Forstrath" (councillor). The "Oberf
meister" and "Forstrath" are each allowed an amoun
exceeding 2,900 marks for traveling expenses.

Among the best German forest periodicals are the
estry and Hunting Magazine, by Dr. B. Dankelm
Royal Prussian "Land Forstmeister" (forest councillor)
director of the forest academy at Eberswalde, and the
estry Magazine, by "Oberforstmeister" Weise, directc
the forestry academy at Muenden. "The forestry c
tions of Prussia," by Julius Springer, Berlin, is alsc
ferred to.

PRIVATE FORESTS.

The extent of private forests in Prussia, as above st
is 10,828,780 acres. About one-half of these forests
managed on forestry principles, and their average val
somewhat less per acre than that of the state forest. O
larger estates the area devoted to forests graduall
creases, while on the smaller estates the forest area
ably decreases.

Some of the forests of Prussia are attractive resort
travelers, and especially pedestrians, who enjoy the e
lent roads. Of the celebrated Thuringian chain, whi
miles in length by from 8 to 25 miles in breath, a w

A FOREST ROAD AND A SPRUCE AND SILVER-FIR FOREST IN THE BLACK FOREST.

(Photos loaned by Mr. Austin Carey and Mr. John Gifford.)

says: "The successive hills melt into each other in gentle undulations, forming a continuous and easily traced comb, and only the northwest slopes are precipitous, and seamed with winding gorges. This mountain range incloses many charming and romantic valleys and glens; the most prominent feature of its picturesque scenery is formed by the fine forests, chiefly of pines and firs, which clothe most of the hills."

Prussia comprises nearly two-thirds of the entire extent of the German Empire, yet its area lacks considerable of being twice that of Minnesota. Thirty-one per cent of its soil is predominantly sandy, and on the whole probably is not as good as that of Minnesota; yet it sustains a population twenty-five times as large as that of Minnesota. This fact might well find a lodgment in the minds of our statesmen, that whereas Prussia annually derives a net revenue of $1.33 an acre from her 6,000,000 acres of state forest, our state, from about an equal area of land in its borders, adapted to forest, derives no regular net revenue at all.

WHAT A MAINE TIMBER EXPERT SAW OF GERMAN FORESTRY.

Mr. Austin Cary, a timber expert of Bangor, Maine, who lately visited Germany to study its forestry, furnishes a very interesting and valuable paper on the subject in the report of the Forest Commissioner of Maine for 1896, from which I take the following extracts:

> It is my purpose here to try to give some little idea of German forestry. Germany is an old country. Centuries ago what we might call its virgin timber was exhausted, and the country found itself with a dense population dependent on a limited area of land to supply its needs for wood material. What should they do? Should they stint their use in this direction to a niggardly amount? Should they exploit new territory and call on the stocks of newer countries for their supply? They did neither of these things. They went to work rather on their own soil to develop fully the resources and capabilities of their own land. The states and the nobles supported the work. Scientists

labored and managers experimented. Forest schools were established to spread through the land the knowledge of what had been gained. Finally they piled up a mass of exact information about trees and everything related to their life, and established a system of forest management based thereon, that is one of the finest monuments of the thoroughness, the conservatism and the patience of the German race. And to-day the forest stands as one of the prime objects of the people's regard, a source of health, wealth and national independence.

This report is concluded after several months' study on the ground of the forests of South Germany. As illustrations of what scientific forestry can do I wish to tell of a few representative facts that came under my own observation.

The first forest of which I gained any knowledge was the property of the city of Freudenstadt in Württemburg. I remember thinking as I rode up to the place by rail and found it a city of 6,000 inhabitants, that it wouldn't do for a man like myself, who wished to see nothing but woods from morning till night, to live in the city. I would get off into the woods themselves and live. How great was my mistake! The forest was all about us. In five minutes' walk from the center of the city one could step into such fine woods as cannot be found in the whole state of Maine. Spruce and fir trees two to three feet through and all the way up to 130 feet high stood on the ground as thickly as they could stand. There were acres there that would cut more than 100,000 M. The previous summer I had cruised all through the spruce lands of the Kennebec, and here on single square miles was more timber than on whole townships on that river. And the best of it was that this was no new or exceptional thing. The whole area of the forest was doing it. If it hadn't old timber it did have young, which is quite as essential to the result. They were growing that timber right along because they knew how to do it and because they were patient enough to wait for results.

The financial returns from this forest will be of interest. The yearly net revenue derived from its 5,950 acres had amounted in the last few years to from $20,000 to $25,000. The yearly yield of wood had been 106 cubic feet per acre. The revenue paid all the municipal expenses of a city of 6,000 people, relieving the citizens from local taxation and paying a bonus to each voter besides.

Baden Baden is another good illustration. The city owns 10,000 acres of forest land in its immediate vicinity, kept under the best of management, just about the equivalent of half a township of our Maine timberland and in much the same kind of trees. The yearly net revenue from this tract, as an average from 1881 to 1891, was nearly $3.50 per acre. That is about the total valuation, timber, land and all, of a pretty good Maine township. A yearly net income of $35,000 has here, it can readily be understood, a significance in connection with municipal expenses.

These two instances are by no means exceptional. The Black Forest, in which both these tracts are included, is a region of high and rough land about a million acres in extent, partly in Baden and partly in Württemburg. It is well cut up with railroads and turnpikes; it has towns and villages scattered all through it, but much the greater portion of its area is covered with trees. It is divided in ownership between the states, cities and towns, and private individuals, of which the publicly owned forests are uniformly well managed. The State forests throughout this district yield a net yearly revenue of $2.50 per acre. Tracts of unusual productiveness have yielded $10. The best feature of the situation is the certainty and regularity of the supply. The management is splendid in its conservatism. Timber is never cut till it is ripe. Managers take a pride in never making a false show by over-cutting. The yearly growth on these forest areas is closely known. Mills and markets have adjusted themselves to their output, and business in consequence is regular and certain.

In speaking of these results of German forestry we must not mistake the conditions to which they are in part due. German forest land in the first place is superior to ours. The soil is deeper and better as a rule, because the country was never glaciated in any such way. Some of their tree species moreover are faster growers than our own, though they have nothing equal to the American white pine. Then wood material in German forests is worth much more than in our woods, because it is close to a dense population which needs it. German forest management, however, is in itself a noble achievement. Without it, favorable natural conditions would be of little avail. By its means, Germany devoting a third of its territory permanently to forest—that third which is of smallest value for agricultural and commercial use—has been able not only to supply all her own demands for most kinds of wood material, but to furnish large amounts to less provident neighbors.

With these facts in mind as to the results of German forest management, the way is perhaps prepared for a statement of how they have been attained. Here we must be extremely brief. I propose as that bit of German forestry which seems to have most help in it for us in studying how to make the most of the woods of Maine to give in outline the history of a stand of spruce and fir in the Black Forest as it works out under the guiding hand of an Oberförster of the Baden State.*

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* Scientific readers must not hold me to strict accuracy here.

First of all, how does it start? How do the young trees come there? Most readers probably will think they are planted, but such is not the case. The man who has a big bill for nurseries and planting in his accounts is marked as a poor manager, and another may be found to take his place. No. It is rather by understanding the conditions which seeds require to germinate and young trees to thrive in, and making use of this knowledge in clearing off the old crop, that the young stand is founded. Let us, however, omit this for the present, and taking the young stand when it first has possession of the ground, trace through its history.

A twenty-year-old stand of spruce and fir in the Black Forest looks like one of our thickets that we say is as thick as the hair on a dog's back. The little trees stand closely together, their foliage is high up, and the limbs on the lower trunk killed off. Many of them by force of competition die every year, and when big enough the dead ones are taken out for fuel. And this dense condition is desired and promoted. The unbroken cover of leaves keeps the soil moist in summer so that growth is more rapid than it would otherwise be; the dense crowding cleans the lower trunk of limbs so that the heart lumber of the mature tree will be nearly clear. The trees on an acre of German forest are of approximately the same age. Experience has shown that more lumber and better lumber in the long run can be grown in that way than if trees of all sizes are kept on the ground at the same time.

Such is the condition of things up to forty years of age. The young stand is practically allowed to take care of itself, and this it does to entirely good advantage.

At forty years of age, however, at which time the young trees might be four to eight inches in diameter and fifty feet high, a strong thinning is made. Poor and deformed trees are taken out, those that are diseased as well, and such also as are overcrowded and seem destined to an early death. By this means the stand is much improved. Every tree left standing is one that is straight and good, and it has a good chance to grow. The stand by this treatment may be left pretty open in places, but in the next few years it closes up again. The trees stand as thickly on the ground as they can stand. The dense foliage shields the soil from drying out, and prevents the encroachment of bothersome weeds. The density of a middle-aged stand in a German forest, the completeness with which it occupies the ground, is something hardly to be conceived till one sees it. Second growth pine groves are all we have in this country that approaches it. The shade of the foliage is so dense and complete that not a young tree or bush will be seen for rods. All that covers the soil is a fine, even coating of moss.

So the thing stands for forty years more. Only the trees that are crowded out are removed from the ground. These have a value to sell but none to grow. Most of them go into the manufacture of paper.

At eighty or one hundred years of age, however, another condition of things begins. Spruce and fir at this age will no longer stand densely together. They open of their own accord. Through blowdown or disease, also, little openings in the cover occur, and under these openings, where the sunlight gets down to the ground, a strange thing happens. Little seedlings, which up to this time may have been absolutely lacking, though the ground was showered with seed, begin to appear on the ground. Sometimes there is a perfect mat of them, and the forest manager, remembering that the time is not far distant now when his timber will be mature, when he will have to cut it and will want to replace it with another of the same kind, welcomes their appearance and cares for their welfare. As they grow larger and require more light and air, he opens up the old stand around them. With that, too, the patch of young trees spreads. More thinning out assists it; different regions of thinning run into one another. Finally the whole area of the stand has been lighted up, young trees have followed the favoring treatment and a dense crop of them covers nearly every square rod of the ground. Much of the old stand has in the meantime been reaped. What remains to be done is simply to clear off the balance with due regard for the welfare of the succeeding stand. By these measures and on these principles the land, in the course of 120 years, handled, of course, meanwhile by many individual managers, but always with regard for its productiveness in the long run, has produced a magnificent crop of timber, has yielded in the thinnings material much more than paying for the labor of its cutting, and it has afforded steady labor at about the rate of one man per 100 acres to four generations of men. During the last thirty or forty years of that time, simply by gradual removal of the crop and care for the young growth which succeeds correct handling of the conditions of light and soil, a new crop has been started ready to carry on the same process in its turn.

How much of the German practice may be adopted here to advantage, how much of it is possible under our business conditions, can only be told after trial. Whatever we do adopt will be gradually taken up. Many of the measures that are recommended from that source are the same that have been suggested to us already by the facts of our own woods.

Something we must take, however, from the general attitude of the German people to the forest. The facts of the situation, indeed, will compel us. The forest will have to be regarded as a field rather than a mine. Having attained that, we shall have further to learn conservatism and patience. Patience is an essential in successful forest management. Trees grow but slowly to a mature condition. If they are cut before they are fit, the best results, the greatest aggregate returns, cannot be reaped.

On most sites the first principle of forest management, as it must come here, is that principle so often referred to as being already in the minds of our practical men—sparing the small trees. This policy is rendered all the more desirable by the fact that has often been pointed out in the course of this work, the vitality of spruce under shade, its ability to thicken up and grow after long and severe suppression. This policy, as often indicated in this work, will have to be applied with discrimination. The problem of windthrow will be a most troublesome one. The man who has to decide whether timber can be safely left, or whether if left it would merely be condemned to blow down, will have set him oftentimes a very difficult problem.

One great object of conservative forest management, however, will be the preservation of the small trees. With this in view many changes in our present lumbering methods will doubtless in time be made. In some directions the detail of the German practice may help us. Thus the Germans avoid cutting in the coldest weather when wood is brittle. On the other hand they like to cut when there is deep snow. That saves the little trees from destruction in felling.

A cardinal principle of the German practice, having value in this as well as in other connections, is never to clear off the whole or the bulk of a stand at any one time. This treatment greatly helps the young trees. Comparatively few are killed when but a portion of the overgrowth is taken, and injuries received they have opportunity to repair. Where a whole stand is cleared off at once little in the way of young growth will survive it.

How far we may be able to follow the example set us it is impossible without trial to say. Perhaps it will be possible in the not distant future to leave half the merchantable timber in a virgin stand for further growth. Such a course would insure a great volume growth on the land; it would allow each tree to be kept till it reaches its finest development; it would help to maintain the proportion of spruce seed supply needed to keep possession of the land. * * *

In Germany the workmen in the forests are trained, almost skilled laborers. They work all their lives at their business; they are well paid as labor goes in that country; living with their families in the forest, they are put in no such social conditions as are the men in our woods. The German forest laborer is a steady, well-conditioned, contented man, who takes a pride in the forest in which he works.

SWITZERLAND.

The Swiss Confederation is composed of twenty-two cantons, which are separate and sovereign states; and while each canton has legislative authority over forests, the Confederation also exercises legislative authority over them in certain regards. Under Article 24 of the Federal Constitution of May 29, 1874, the Confederation controls only the forests of the high regions, which are about 65 per cent of the total forest area of Switzerland. It is true that since the popular vote of July 11, 1897, which revises the said article 24, the Confederation has from now on the right of inspection of the forest police of the whole of Switzerland.

The federal law of March 24, 1876, which puts into execution the above-named article 24 of the constitution, was promulgated for the forests of the high regions. By the terms of that law the inspection by the Confederation extends over the entire territory of the cantons of Uri, Schwytz, Unterwald, Glaris, Appenzell, Grisons, Tessin and Valais and over the mountainous parts of the cantonal territories of Zurich, Berne, Luzerne, Zoug, Friburg, St. Gall, Jura and Vaud; but the law does not apply to the forests of the plains of the last-mentioned states, nor to the forests of the cantons of Soleure, Bale, Schaffhouse, Argovie, Thurgovie, Neufchatel and Geneva.

The Confederation is not actually the owner of any forests but a few of the separate states are owners. The forest domains are part of the national wealth, and comprise 91,587 acres. There are also in the cantons the forests of the municipalities and of the corporations, comprising 1,403,772 acres. Besides there are private forests, comprising 609,855 acres. The total area of forest is therefore 2,105,220 acres, or about 20 per cent of the total area of Switzerland.

Forests are found everywhere in Switzerland. The parts most heavily timbered are the mountain chains of Jura and of the cantons of Schaffhouse, Soleure, Argovie and Ne chatel. Forests are found starting at 200 metres above s level (in the canton of Tessin) and reach as high as 2,1 metres in the high mountain. In Argovie they even rea 2,300 metres in altitude.

The more common varieties of trees are, among th resinous kinds, the opicea, the fir, the larch, the Scotch an mountain pines, the Siberian pine; among the deciduou kinds, the birch and the chestnut tree; this last kind grow especially in the canton of Tessin.

The value of forest land varies greatly and depends o the location, the nature of the soil, thickness of the settlements, the increase of these settlements and on the trade in timber and other products of the forest. The value per hectare (2½ acres) may range accordingly from 300 francs to 6,000 francs.

In regard to expenses of administration, a distinction must be made between the expenses incurred by the Confederation and those incurred by the cantons. In 1897 the expenses incurred by the Confederation for forest administration amounted to $56,000.

The following are the net receipts from forests in 1896 as to a few cantons:

Zurich, 180,900 francs, or 91.06 francs per hectare of forest.
Berne, 893,000 francs, or 71 francs per hectare of forest.
Soleure, 33,400 francs, or 44 francs per hectare of forest.
St. Gall, 71,000 francs, or 84.60 francs per hectare of forest.
Argovie, 241,000 francs, or 78.73 francs per hectare of forest.
Vaud, 236,000 francs, or 32 francs per hectare of forest.

The net receipts from town and municipal corporation forests in 1896 were:

Canton of Grisons, 1,200,000 francs, or 10.40 francs per hectare of forest.

Canton of Argovie, 2,378,000 francs, or 70.60 francs per hectare of forest.

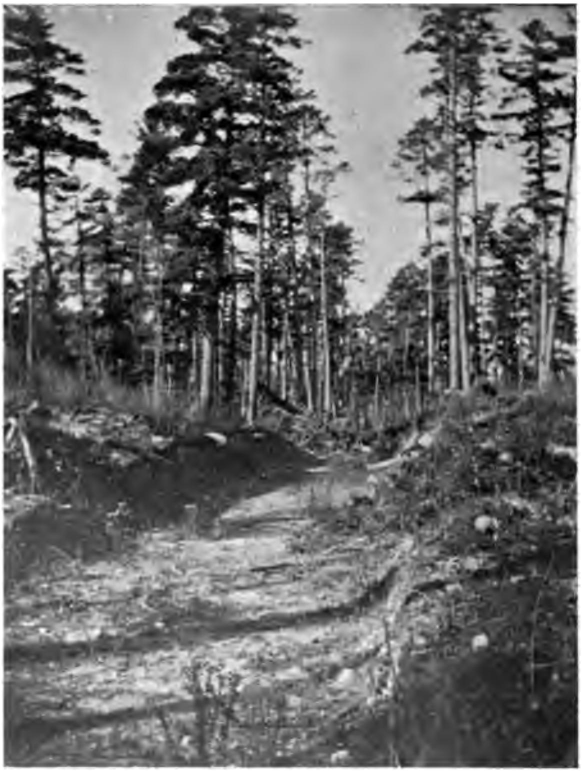

Photo by F. L. Hoxsie.

LOGGING RAILROAD BED IN HUBBARD COUNTY,
NEAR WALKER.

On an average about 412 acres of forest have been created annually during the past twenty years, at the expense of the federal treasury.

In order to regenerate the forests, both planting and natural seeding are practiced, as may be most effective. In the lowest countries where clean cutting is practiced, planting is resorted to. Where real dangers exist from avalanches, land slidings, etc., which do not permit complete denudation and where gardening is required, natural modes of regeneration are generally used, and sowing is seldom done.

Reforesting by the Confederation in high mountain regions costs on an average 400 francs per hectare for 6,000 to 7,000 plants set in their place.

The federal and cantonal legislations prescribe a sustained production for the forests of the state, of the towns and of the municipal corporations. If, through winds, snow-slidings or otherwise, too much timber has been destroyed, less cutting is done in the following years, in order that as rapidly as possible the forest may regain the number of trees fixed by the management. The forests are operated in various ways, according to localities and according to the size of timber that is to be grown, viz.: high forest, under-growth and coppice (*de hautes futaies, de taillis sous futaie ou de taillis simples*), which three modes of management are found in Switzerland.

In accordance with the terms of the federal law, the forest area cannot be reduced. The cleared land must consequently be reforested except in cases where an equal area of land is converted into forest. Furthermore, the cantons as well as the Confederation have the right to compel the creation of protective forests wherever they are needed for public utility.

Forest fires seldom occur. Of those which do occur the principal causes are carelessness in lighting fires in the immediate vicinity of the forests, and lack of care in the woods. It is rare that a forest fire is occasioned by locomotives.

The administration charged to execute the federal forest law is the Federal Inspectorate of Forests, forming a part of the Swiss federal department of the interior. Nearly all the cantons have for their territories a forest administration. In the small states one single technical official is at the head of the service, but in the larger cantons the administration is under the direction of one or more chief forest inspectors or chiefs of the service and of several district foresters or forest inspectors. An inferior personnel instructed for the federal zone in courses lasting two months is attached to this technical personnel, and is organized to execute the work of forest economy.

A few cities or towns with extended and important forests have also a self forest administration, at the head of which is a person of technical forest training. Among them are Zurich, Berne, Lausanne, St. Gall, Winterhue, Friburg, Coire, Soleure, Schaffhouse.

The Chief Federal Inspector of Forests has an annual salary of 8,000 francs and fees of 8 francs per day and 8 francs per night, when he has to be absent, for his service; he gets his traveling expenses reimbursed; his first assistant has a salary of 6,400 francs and is similarly indemnified for his inspection trips.

The three inspectors of the canton of Berne receive each 5,300 francs per annum. They receive extra pay, 6 francs per day and 4 francs per night, for all inspections made outside of their city and their traveling expenses are reimbursed.

The high forester or chief inspector of the canton of St. Gall, who has a salary of 5,000 francs, receives 10 francs per day and 4 francs per night, besides his traveling expenses, when out inspecting.

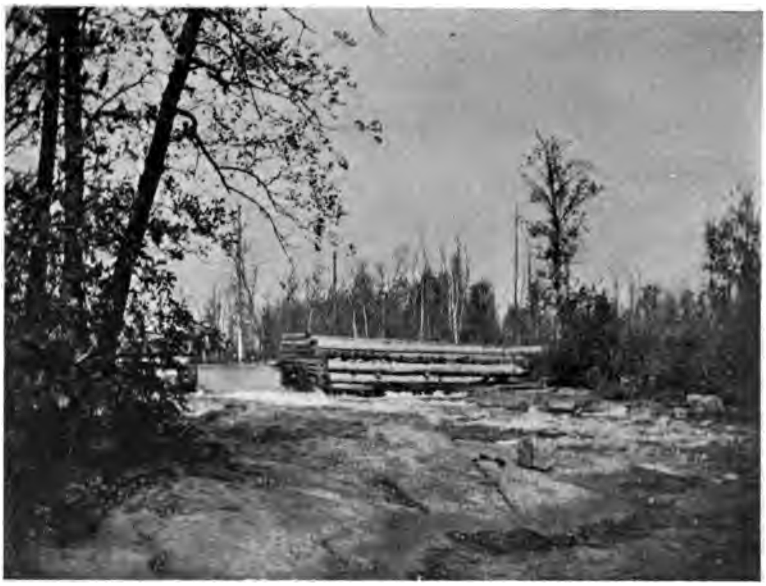

Photo by F. L. Hoxsie.

LOGGING DAM AND SLUICE ON RUM RIVER IN MILLE LACS COUNTY.

The Federal Inspectorate of Forests publishes every year a report on its management. The majority of the cantonal inspectors do likewise.

The following are monthly forestry publications:

Journal Suisse d' E'conomie forestiere; Der prattische Forsturet.

In the matter of taxes, the cantons are sovereign in their own limits. Taxation therefore differs according to the cantonal territory to which it applies. In all these states a tax on the fortune is imposed, and in most states that tax is combined with the tax on income. But for one and the same forest only one of these two modes of taxation is generally applied. A few examples will show: In the canton of St. Gall the state has paid to the towns in which it has forests a tax of 1.20 francs per hectare.

In Argovie the state pays to the towns where its forests are situated a tax of 2.40 to 3.20 francs per 1,000 francs of forest value. On the other hand, the towns only pay to the state a tax of 40 centimes per 1,000 francs of forest value. The private forest proprietor pays to the state 40 centimes and from 2.40 francs to 3.20 francs to the towns per 1,000 francs of forest value; and in addition thereto he is taxed on the income in the amount of 1 per cent of the average gross 2 per cent assessed forest value, but neither the state nor the towns pay a tax on the income of their forests.

A SWEDISH FOREST MANAGED AS AN INVIOLABLE INCOME YIELDING CAPITAL.

The forest of the Boxholm Company, situated in the province of Ostergotland, in the south central part of Sweden, on the principal railway from Copenhagen to Stockholm, and about sixty English miles southwest of the port of Norrkoping, is managed on forestry principles; that is, it is managed with a view to a sustained yield, and for that reason a short account of its present situation will be of value. Including pastures the forest comprises 55,000 acres, the surface is rather hilly, and 20 to 30 per cent of it is rocky; soil sandy and gravelly and for the most part unsuitable for agriculture. In the forest proper three-fourths of the trees are pine and one-fourth spruce; in the pastures birch, pine and spruce together or mixed. On an average about 250 to 500 acres are cut over annually; and old forest generally yields 100 to 150 cubic meters per tunnland (one tunnland equals one and twenty-two hundreths of an acre), of which 70 per cent is merchantable timber. Hitherto the forest has been cut in stands having an age of 100 to 150 years or older, together with thinning in younger stands; on the high land the forest is usually cut at the age of 50 to 70 years, although clean cutting seldom occurs. The annual product is about 50,000 logs of full tree length, 6 inches and upwards in diameter at the top; 20,000 cubic meters of charcoal and all timber required for building, repairs, fencing, etc.

Of the cut-over area on high land perhaps one-third part becomes reforested naturally by self seeding. Cutting in strips is not practiced, but it is considered preferable to make small clearings, and first in that part of the forest which is more distant from the prevailing winds. To effect reforesting by sowing seed, the ground is first cleared of leaves, twigs and moss by burning, which usually is done in the spring or summer. The following year, or, if the burning takes place in the spring, then the same year if one chooses, the ground is then prepared in pieces a foot square, at proper intervals, and the seed sown in them. The first year the young plants are protected from pasture animals by fencing. About 2,500 seeds are sown per "tunnland." On grassy places planting occurs instead of sowing. Planting at the Boxholm forest is done partly with transplants (plants which had previously been taken from the nursery and set in other ground), which are set in holes either with the roots only or with the adhering clumps of earth; partly with seedlings (plants direct from the nursery or first bed), which are set in filled holes with a planting pin. Pine transplants are generally three and spruce four to five years old. When seedlings are used they are, if pine, generally one year old and spruce seedlings two to three years old. The number planted on a "tunnland" varies from 1,500 to 2,500.

The number of timber trees cut on a "tunnland" averages about 100. During even very dry seasons not much is done to prevent forest fires. The forest watchmen perhaps exercise more attention and employ more care; and generally the precautions against forest fires prevent their gaining any great extent. In case any part of the forest is burned, it is, after a year's time, resown to forest.

The cutting of timber in this forest has been in progress by the present company twenty-five years; and in previous years it had been operated for timber and charcoal.

There are scores if not hundreds of such forest properties in Sweden.

DUCHY OF BADEN.*

STATE FORESTS.

The aggregate extent of the state forests of Baden is 240,304 acres, located in the Black Forest and the upper valley of the Rhine. The prevailing kind of trees is coniferous. The beech, however, covers the largest surface; next follows the fir, then the silver fir and the Scotch fir. The average estimated value per acre, taking the average of the ten years 1886-1895, is $98.55. The annual aggregate expense of administration is $568,078. The annual aggregate revenue amounts to $1,235,332, and the net revenue is $667,244. Number of acres annually sown to forest is 222, and the number of acres planted is 823. Reforesting is effected by seed from standing trees; also by planting trees, in some rare cases by artificial sowing, the latter in the case of firs. There is a gradual increase of crop. The usual method of cutting the crop consists in cutting the mature trees and covers at periods, as a rule, from thirty to forty years, with longer or shorter intervals. Cutting in blocks clean (pines and Scotch firs) in exposed stormy situations is less frequent. According to paragraph 29 of the Forest Law of Baden of the year 1879, no part of any forest is allowed to be kept uncultivated. The number of forest fires during the years 1879-1888 was 61, the damaged surface 99 acres, and the damages amounted to $2,225. The principal causes of such fires are negligence, when burning down the skirts of the forest, or by throwing away matches or stubs of cigars. Very few cases of fires are caused by railroad locomotives.

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*This and the two following sketches of forestry in Bavaria and Wurtemberg were printed in my report for 1896.

The forest service ranks equally with other branches of the public service, and is comprised in Class D of the tariff of salaries. Seven members of the Administration of Domains (which forms a part of the Treasury Department) are the highest forest officers; they bear the title of Councillors of the Forest Board, and have a salary not exceeding $1,380 and $147 compensation for rent.

Besides the state forest there are community and corporation forests, covering a total surface of 555,069 acres, which are managed on the same principles as the state forests.

PRIVATE FORESTS.

The aggregate extent of the private forests is 451,670 acres. About one-third of all private forests is managed on forestry principles, including the forests of the Public Administration of Street, River and Railway Construction, and the most extensive and important private proprietors. The total forest product of the country increases gradually.

BAVARIA.

STATE FORESTS.

Bavaria, whose attractive capital, Munich, is frequented many Americans, has 6,000,000 inhabitants. Its for-

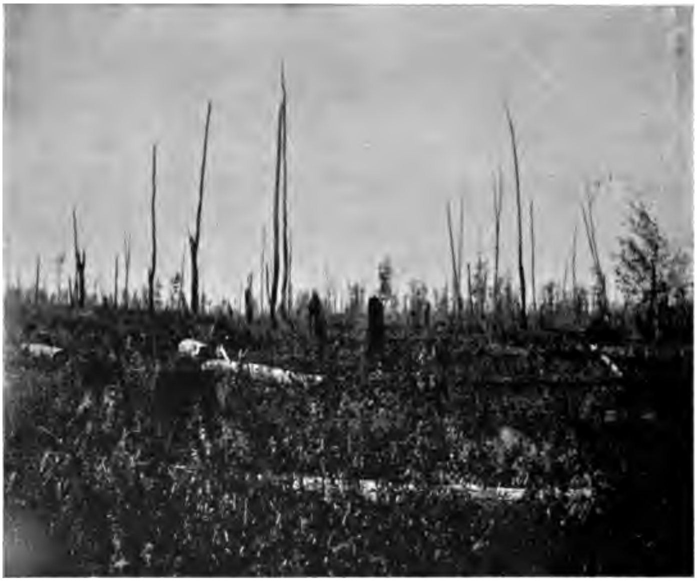


Photo by F. L. Hoxsie.

CUT OVER PINE LAND IN MILLE LACS COUNTY, BURNED PREVIOUS TO 1895.

ests comprise 2,150,000 acres, of which 34.08 per cent are the property of the state. Large forests are to be found in all parts of the kingdom; but as a general rule the mountainous districts in the south (Alps), the north (Spessart) and northeast (Bohemian Forest) are covered with the densest forest. Of the whole area of the country 33 per cent is covered with forest. The prevailing kind of trees, or 77 per cent, are coniferous. The remainder comprise various kinds of deciduous trees—those losing their foliage in winter. Among the conifers red and white pine are most frequent. Among the deciduous trees the beech occupies the greatest space. The oak is also cultivated quite extensively for tanning purposes. The average estimated value of the forest land is $50 per acre. The annual aggregate expense of administering the forests (1891) including salaries of officials, wages of workingmen, local taxation, new purchases, etc., amounts to $4,965,204. The total revenue from the forests the same year amounted to $8,187,349. Number of acres sown or planted to forests in 1892 was 14,800, more than three-fourths of which area was planted with coniferous trees. In the case of the red pine and the white pine, reforesting is mainly done in the natural way. In the case of the fir (*Pinus sylvestris*) it is always effected artificially; in the case of the beech, always in a natural way (seed from standing trees); in the case of the oak, generally by artificial sowing. There is a continuity of forest products and a steady increase of the revenue which the state derives from its forests. This is due, first to an increase of prices, secondly to an increase of the yearly crop. The latter must chiefly be regarded as a result of the present condition of the forests which are being and have been steadily improved; also of the economy which was practiced in former times. Where reforesting is effected by seeding from the standing trees, the crop is generally cut in lengthy strips, usually not exceeding about thirty yards in width. As a general rule the administration of the state forest makes it a principle to avoid cutting in large blocks clean. In regard to compulsory tree planting, it may be said that every forest area, the trees of which have been cut, no matter whether state or private property, must be reforested in a short time, unless evidence can be furnished that the land would be better adapted to agricultural purposes.

The damage caused by forest fires is quite insignificant, being in 1890 only $974, in 1894 only $1,686. The principal cause of such fires is the carelessness of the workingmen employed in the forests and of individuals and parties making excursions, particularly on Sundays. There are no data at hand as to the number of such fires caused by railroad locomotives, and although some fires are no doubt so caused, the number is certainly very small.

The administration of the Bavarian state forests constitutes one of the departments of the ministry of finance. It is directly subordinate and responsible to the latter, no other authorities intervening. The highest forest official who may be regarded as being at the head of the forest administration, responsible, of course, as stated, to the minister of finance, bears the title "Ministerialrath,"—ministerial or cabinet councillor. The chief director of the Bavarian administration of state forests is "Ministerialrath" Ganghofer. His starting salary is 7,740 marks. After a sixteen years' service the salary advances to 8,820 marks. Next in rank are the so-called "Oberforstrathe," with a starting salary of 6,660 marks, which after a sixteen years' service, is increased to 7,740 marks.

There is no regular report published on the administration of the forests; however, the reports of the Royal Bavarian Bureau of Statistics, which are published four times a year and the "Statistische Jahrbuch fur das Konigreich Bayern," which is issued annually since 1894, contains some data referring to Bavarian forestry. In addition budget reports on the administration of the state forests are submitted to the "Landtag" or Diet every second year.

PRIVATE FORESTS.

The aggregate extent of private forests was 3,149,400 acres in 1893. In addition to the state and private forests there are about 800,000 acres of forests belonging to separate towns and villages. The forests which are owned by great landholders are managed on forestry principles. These forests, however, only comprise a very limited area, somewhat less than 400,000 acres. Most of the private forests are the property of small landholders. The average value per acre of private forests is somewhat less than that of the state forests. The net income rate varies widely. The data at hand are too few and too unreliable to admit of arriving at any conclusion with regard to the average. Opinions vary as to whether the total forest product of the country increases or decreases. In general the extent of the private forests seems to be somewhat decreasing. This would of course also appear to entail a decrease of the total forest product. Forest lands are only allowed to be changed into agricultural lands when proof can be furnished that the agricultural crop may be expected to exceed in value the forest crop. Between 1886 and 1891 from 7,000 to 8,000 acres of private forests were newly planted or sown.

WURTEMBERG.

Wurtemberg lies west of Bavaria, and is the third German state in point of area, its population being a little over 2,000,000. Its greatest length from north to south is 140 miles, and its greatest breadth is 100 miles. One-third of the Black Forest (so called from the dark foliage of its pines, and which forms a sort of a triangle,) lies within Wurtemberg, two-thirds being in Baden. The Black Forest has a total length of 93 miles, and its breadth varies from 13 to 46 miles.

STATE FORESTS.

The aggregate extent of the state forests is 418,904 acres, and they extend over the entire kingdom: 59 per cent of the forests consists of pine, 20 per cent being pitch pine and 9 per cent white pine. The estimated value of the forest land varies from $29 to $58 per acre. The annual aggregate expense of administration of the forest amounts to $1,183,574. Of this $364,140 is paid to wood-cutters, $147,560 is expended on roads, $90,440 in forest culture, $259,468 for pay of officials, $138,468 for forest guards. The revenue for 1895-1896 was $2,928,352, yielding a net revenue, after deducting all expenditures, of $1,744,778, or $3.63 per acre. The number of acres annually sown to forest is 296, and the number of acres planted to forest, 6,177.

In regard to reforesting, when the natural seeding of the desired kind of wood occurs in proper time the same is used; otherwise planting or artificial sowing takes place. Natural sowing is estimated at about 25 per cent, artificial renewing amounts to about 75 per cent. The latter is almost exclusively done by planting, whereas sowing in free woodland is very seldom applied. It is a principle to maintain (as far as the division of the age of the plantings permit) an equal annual cutting. At present the cutting is fixed at 1.94 cubic metres per acre. The cutting is contracted for with laborers living in the neighborhood of the woods. By good management there are at a given plot generally trees of about the same age. If the natural seed falling is intended to be used, the larger trees, either single or in crops, are cut out in a direction against the prevailing winds; the remaining trees are thinned and gradually cut out as the growing young trees may demand. If the natural seed falling is not taken into consideration, the wood crop is cut clean in narrow strips, also in a direction against the prevailing winds, and the cutting of the second and following strips is postponed until the young plantings can dispense with the side protection of the old woods. It is a principle that replanting follows immediately after the cuttings. Moreover the state buys every year about 400 acres of woodland to increase and round off the forests.

The amount of damage annually caused by forest fires only $642.60, and the principal cause of such fires is carelessness and negligence while smoking and lighting fires

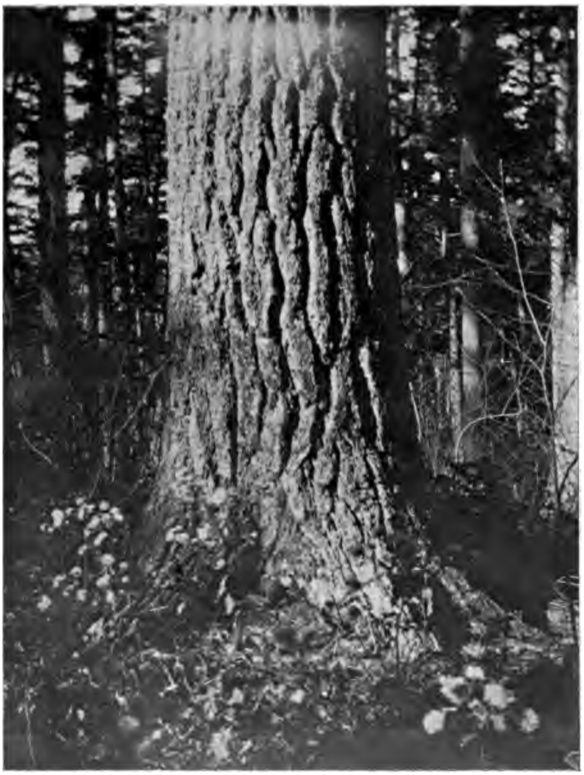


Photo by F. L. Hoxsie.

SECTION OF WHITE PINE, 30 INCHES IN DIAMETER, NEAR WALKER, CASS COUNTY.

in or near the forests. In the last ten years out of 120 forest fires only 8 were caused by sparks from locomotives and of these only one caused considerable damage (about $3,570).

In regard to the rank in the forest service, as compared with other branches of the public service, it may be said that the forest officials rank in general equally with those state officials who are graduates of the university. The Department of Forests is directed by one president, four technical and four administrative members and one commander of the forest guards. The salary of the president is $1,844.50 per year; the salary of the members of the Board of Direction is from $1,190 to $1,618. A work entitled "The Forests of Wurtemberg," published by Rueger, Stuttgart, 1880, gives a fair review of the situation of the forestry of the country. It may here be stated that in respect to net revenue Saxony and Wurtemberg stand at the head of forest administration and forest culture in general.

PRIVATE FORESTS.

The aggregate extent of private forests is 528,794 acres, of which 210,000 acres are administered by technical forest officials; the remainder is also administered in a proper manner. As the permission of the government is required for cutting and replanting of forest lands, and this permission is only given under the condition that an equal area to what has been cut shall be planted, the aggregate area of forest land remains the same throughout the whole country; but portions of it are gradually coming into the possession of the state government.

Progress of Forestry in Other States.

The first important forestry meeting in this country was the Forestry Congress at Cincinnati, in 1882, an organization since changed to the American Forestry Association. Fifteen years ago a division of forestry was established in the Department of Agriculture, Washington City, for scientific experiment and investigation in forestry. The President, through a commission of able scientific men, has lately set apart extensive forest reservations in several of the Western territories and states, and it is to be hoped that the policy will be upheld by congress.

NEW YORK.

Among the separate states, the Empire State of New York first began important work. Actuated by a desire to prevent forest fires, the State of New York, in 1884, appointed a very able commission to investigate and report a system of forest preservation for the Adirondack region. The next year the legislature enacted a law, recommended by the commission, for a fire warden system (in principle like the fire warden law enacted in this state in 1895, making town supervisors fire wardens) for a forest commissioner, for a superintendent of forests and for several expert foresters.

A very important recent step in the cause of forestry by the State of New York, was its law of March 26, 1898, establishing the New York State College of Forestry in Cornell University at Ithaca, N. Y. The university is authorized to purchase (and the state will pay for) 30,000 acres of land in the Adirondack forests for the use of the college. In addition, the state has appropriated $10,000 to put the college in operation; and Dr. B. E. Fernow, LL. D., for many years chief of the United States Division of Forestry, has accepted the position of director of the college. The following clause in section two of the Act indicates the use that is to be made of the 30,000 acres:

> The university shall have the title, possession, management and control of such land, and by its board of trustees, through the aforesaid college of forestry, shall conduct upon said land such experiments in forestry as it may deem most advantageous to the interests of the state and the advancement of the science of forestry, and may plant, raise, cut and sell timber at such times, of such species and quantities and in such manner as it may deem best, with a view to obtaining and imparting knowledge concerning the scientific management and use of forests, their regulation and administration, the production, harvesting and reproduction of wood crops and earning a revenue therefrom, and to that end may constitute and appoint a faculty of such school, consisting of one director or professor and two instructors, and may employ such forest manager, rangers and superintendents, and incur such other

expenses in connection therewith as may be necessary for the proper management and conduct of said college and the care of said lands and for the purposes of this act, within the amount hereinafter appropriated.

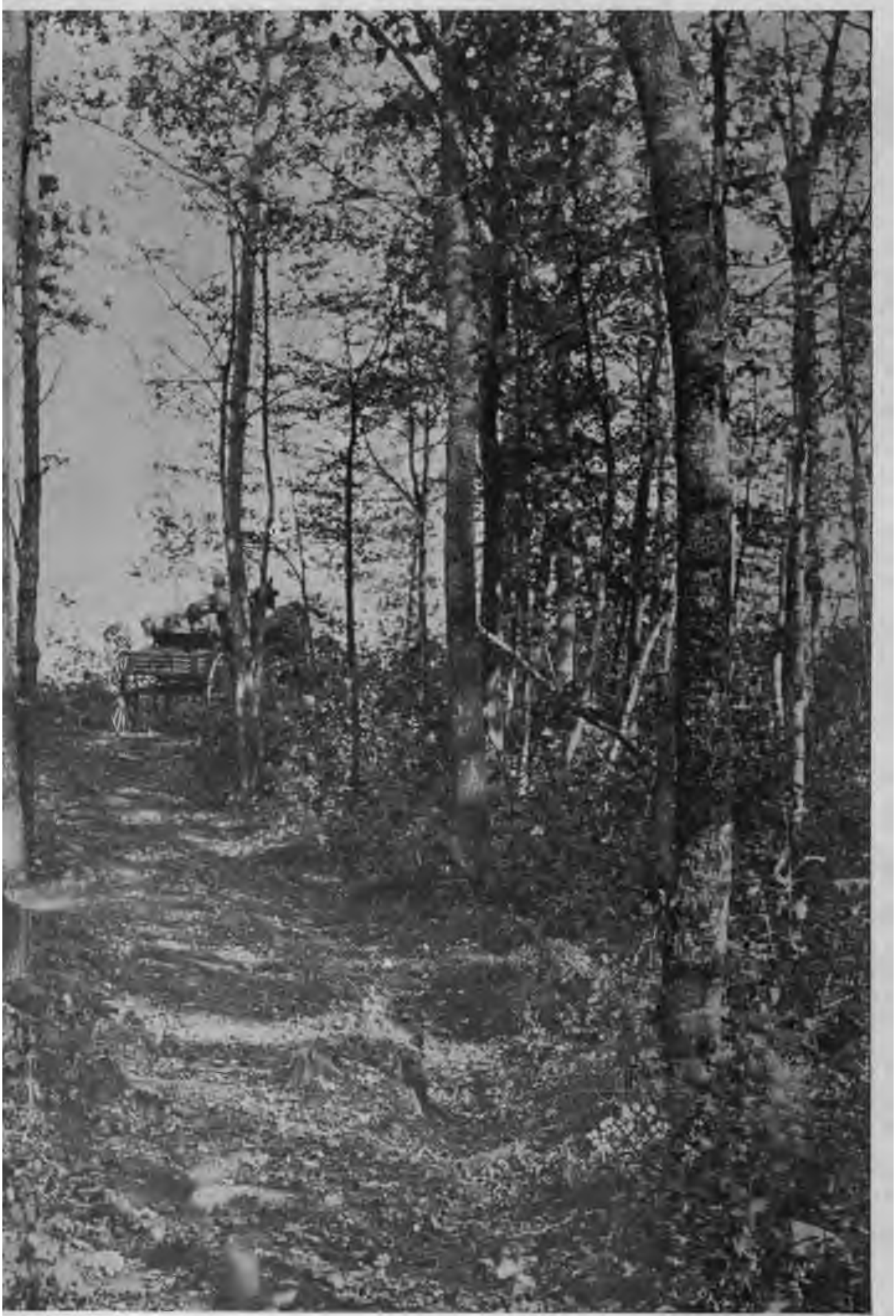
In a very few years the States of Maine and New Hampshire followed the example of New York and created forest commissions, which have done much to diffuse knowledge of forestry, and which have, to some extent, induced lumbermen to manage their timber lands with a view to a sustained yield. The New Hampshire law enables the state to accept and hold donations of land for forest purposes, or of money to buy such land; and some such donations to the state have already been made. One of the New Hampshire forest commissioners goes round with the Farmers' Institute and delivers addresses on forestry. The State of Massachusetts enacted a law last year for the prevention of forest fires. New Jersey is having an official investigation made of the amount of timber growing in the state. Wisconsin, which enacted a fire warden law in 1895, created last year a forest commission to investigate and report a plan for forest preservation.

PENNSYLVANIA.

But it was left for the State of Pennsylvania, the past year, to make a most important forward movement in forestry. She advanced all along the line on the double-quick. A discussion and agitation of the subject of forestry and in which the ladies took an important part, had been going on for some years in Pennsylvania; the governor of the state, as is the case with the governor of New York, is a strong friend of forestry, and the result was that the legislature of Pennsylvania last year enacted four important forestry measures. One of these measures provided for a division of forestry, with a commissioner and clerk in the Department of Agriculture. Constables of towns are made fire wardens. Another act provides that any owner of not exceeding fifty acres of land, having on it forest or timber trees of not less than fifty trees to the acre, of certain dimensions, shall be entitled to receive annually during the period that the trees are maintained in sound condition, a sum equal to 80 per cent of all taxes annually assessed and paid upon the land. Another act authorizes the forest commissioner to bid in for the state any lands offered for sale for taxes which he thinks is desirable for forest reservations. But the most significant and important act of all was one for creating large reservations to aid in maintaining water supply at the sources of the three great river systems in the state. The law provides for taking, by the state, under the right of eminent domain and paying for the same, after due valuation, three forest reservations, as follows: One of not less than 40,000 acres upon waters which drain mainly into the Delaware river; one of not less than 40,000 acres, upon waters which drain mainly into the Susquehanna river, and one of not less than 40,000 acres upon waters which drain mainly into the Ohio river.

NORTH CAROLINA.

North Carolina is distinguished for the splendid forestry work being done by Mr. George W. Vanderbilt on his princely estate at Biltmore, where he is having 8,000 acres of forest managed on strictly scientific principles, under the charge of Lieut C. A. Schenck, Ph. D., of Darmstadt, Germany, a man of the highest practical and scientific attainments. The total area on the Biltmore estate under forests is 88,000 acres, of which 80,000 acres are lying in the higher mountains of the Alleghenies and known by the name of Pisgah Forest. Biltmore forest proper, in the valley of the French Broad river, "is stocked mainly with oaks and short leaf pine of such a quality (the forest having been lumbered over in previous years) that the output of lumber will be for a considerable length of time none or practically none. It is therefore possible only to make so-called improvement cuttings in which any misshaped trees of large and small size are removed and cut into cordwood, hile all healthy specimens of trees growing vigorously and



F. L. Hoxsie.

ED—*MOSTLY HARDWOOD*—FOREST ON SOUTH SHORE OF MILLE LACS LAKE.

promising to develop into timber trees are left standing." During 1897 the wood sales more than covered the running expenses of the forest. A comprehensive system of roads has been developed during the last eight years, which are being extended. Fifty acres of bare land are annually planted to forest.

The Province of Ontario, which has established a grand national park of over a million acres within one hundred and fifty miles of Toronto, has a Bureau of Forestry and a system for preventing and extinguishing forest fires. The annual reports of its Bureau of Forestry are able documents. A Royal Commission of five members appointed in June last for the purpose of investigating and reporting on the subject of "restoring and preserving the growth of white pine upon lands in the province which are not adapted for agricultural purposes or for settlement" personally visited considerable territory in the summer and fall and submitted a valuable preliminary report the 10th of December. New Brunswick enacted a law for the prevention of forest fires in 1885.

CONCLUDING REMARKS.

The State of Minnesota has for twenty-five years annually paid and still continues to pay $20,000 a year in bounties for planting trees on the prairies, "the beneficial result of which," to quote the governor's Arbor Day proclamation, "is seen in the many artificial bodies of timber in the prairie region and which have greatly improved and beautified that portion of the state." The Minnesota State Forestry Association, organized in 1876, was one of the first associations of the kind, if not the first, organized in the country. In 1895 the present forest fire warden law was enacted. Last year the regents of the State University established a School of Forestry in the College of Agriculture under the charge of Professor Samuel B. Green. The study of forestry is included under two courses: "Course 1. Lectures: The forestry situation in this country and its litera-